This is a digital copy of a book that was preserved for generations on library shelves before it was carefully scanned by Google as part of a project to make the world's books discoverable online.

It has survived long enough for the copyright to expire and the book to enter the public domain. A public domain book is one that was never subject to copyright or whose legal copyright term has expired. Whether a book is in the public domain may vary country to country. Public domain books are our gateways to the past, representing a wealth of history, culture and knowledge that's often difficult to discover.

Marks, notations and other marginalia present in the original volume will appear in this file - a reminder of this book's long journey from the publisher to a library and finally to you.

Usage guidelines

Google is proud to partner with libraries to digitize public domain materials and make them widely accessible. Public domain books belong to the public and we are merely their custodians. Nevertheless, this work is expensive, so in order to keep providing this resource, we have taken steps to prevent abuse by commercial parties, including placing technical restrictions on automated querying.

We also ask that you:

+ *Make non-commercial use of the files* We designed Google Book Search for use by individuals, and we request that you use these files for personal, non-commercial purposes.

+ *Refrain from automated querying* Do not send automated queries of any sort to Google's system: If you are conducting research on machine translation, optical character recognition or other areas where access to a large amount of text is helpful, please contact us. We encourage the use of public domain materials for these purposes and may be able to help.

+ *Maintain attribution* The Google "watermark" you see on each file is essential for informing people about this project and helping them find additional materials through Google Book Search. Please do not remove it.

+ *Keep it legal* Whatever your use, remember that you are responsible for ensuring that what you are doing is legal. Do not assume that just because we believe a book is in the public domain for users in the United States, that the work is also in the public domain for users in other countries. Whether a book is still in copyright varies from country to country, and we can't offer guidance on whether any specific use of any specific book is allowed. Please do not assume that a book's appearance in Google Book Search means it can be used in any manner anywhere in the world. Copyright infringement liability can be quite severe.

About Google Book Search

Google's mission is to organize the world's information and to make it universally accessible and useful. Google Book Search helps readers discover the world's books while helping authors and publishers reach new audiences. You can search through the full text of this book on the web at `http://books.google.com/`

BERKELEY
LIBRARY
UNIVERSITY OF
CALIFORNIA

EARTH
SCIENCES
LIBRARY

LIBRARY
OF THE
UNIVERSITY OF CALIFORNIA.
RECEIVED BY EXCHANGE
Class [illegible]

1907.

WESTERN AUSTRALIA.

GEOLOGICAL SURVEY.

BULLETIN No. 28.

THE
GEOLOGY AND MINERAL RESOURCES
OF
LAWLERS, SIR SAMUEL, AND DARLOT
(East Murchison Goldfield),
MOUNT IDA
(North Coolgardie Goldfield),
AND
A portion of the Mount Margaret Goldfield.

BY

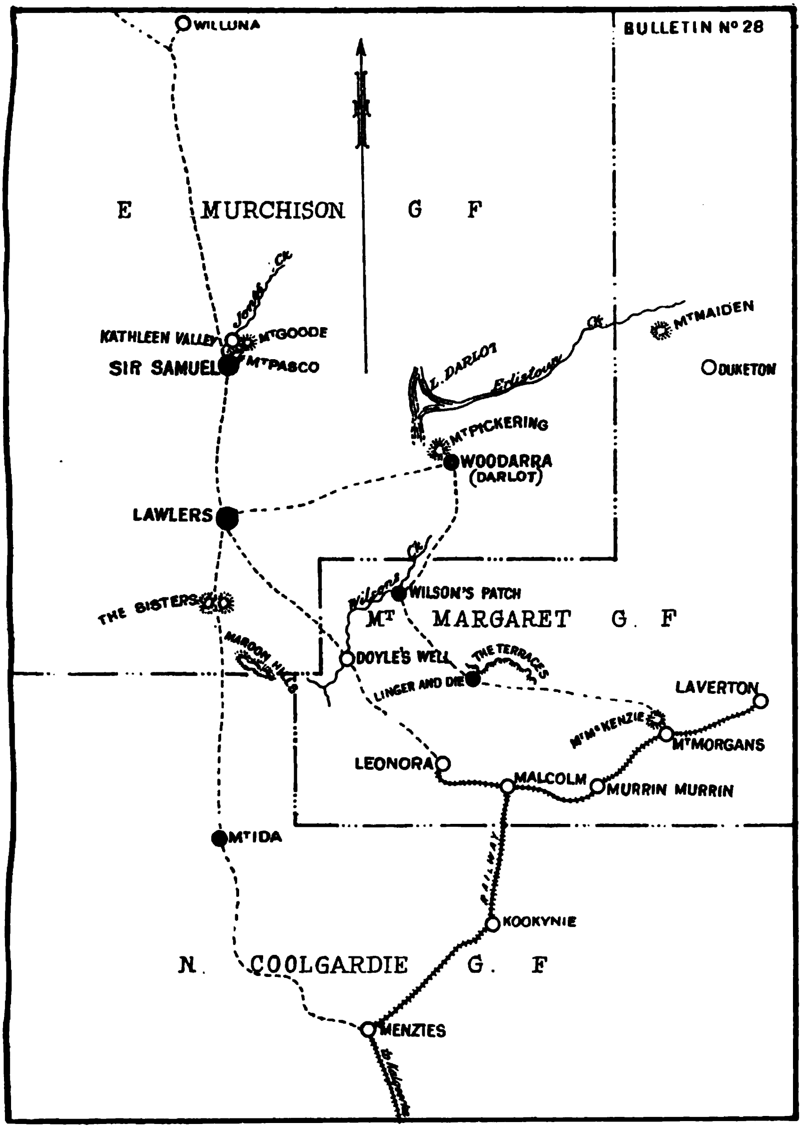
CHAS. G. GIBSON, B.E.,
Assistant Geologist.

Issued under the authority of the Hon. H. Gregory, M.L.A.,
Minister for Mines.

WITH 3 MAPS AND 5 MINING PLANS.

PERTH:
AUTHORITY: FRED. WM. SIMPSON, GOVERNMENT PRINTER.
1907.

FRONTISPIECE



LOCALITY MAP

0 40 80

Scale of Miles

QE348
A3

EARTH
SCIENCES
LIBRARY

CONTENTS.

PAGE

Prefatory Note ... 5

Introduction—

- Mining Centres examined and mapped ... 7
- Boundaries of the East Murchison Goldfield ... 7
- Early History of the East Murchison Goldfield ... 7
- Previous Observations on the Geology of the East Murchison ... 8

Lawlers—

- General ... 10
- Geology ... 10
- Ore Deposits ... 14
- Mines ... 15
- Leviathan District ... 27
- Statistics ... 30

The Country between Lawlers and Mt. Ida ... 31

Mt. Ida—

- General and Geology ... 31
- Ore Deposits ... 34
- Mines ... 35
- Statistics ... 44

The Country between Lawlers and Sir Samuel ... 45

Sir Samuel—

- General and Geology ... 45
- Ore Deposits ... 47
- Mines ... 48
- Statistics ... 50

The Country between Lawlers and Darlot ... 51

Darlot—

- General and Geology ... 51
- Mines ... 53
- Statistics ... 59

The Country between Darlot and Wilson's Patch ... 60

Wilson's Patch—

- General and Geology ... 61
- Mines ... 62
- Statistics ... 65

The Country between Wilson's Patch and the Linger and Die ... 65

The Linger and Die ... 65

The Country between the Linger and Die and Morgans ... 67

Appendix I.—List of Specimens ... 68

Index ... 69

203686

LIST OF FIGURES.

PAGE.
Fig. 1.—Plan showing the mode of occurrence of the Unexpected Reef, Mt. Ida 38
Fig. 2.—Section showing the mode of occurrence of the Ida Reef, Mt. Ida 43
Fig. 3.—Section showing the mode of occurrence of the Ballangarry Reef, Darlot 57
Fig. 4.—Plan showing the mode of occurrence of the Great Western Reef, Wilson's Patch 63

LIST OF PHOTOGRAPHS.

To face page
1. East Murchison United Gold Mine, Lawlers 24
2. Quartz Outcrop, Lawlers—Mt. Ida Road 31
3. Bare Granite Hill, 8 miles North of Darlot 52
4. "Breakaway" (weathered granite), Wilson's Patch 61
5. Table-top Hills, near Wilson's Patch 61
6. "Breakaways," near Wilson's Patch (being nearer view of Photo. 5) 61

LIST OF PLATES.

A. Plan of Copperfield Leases, Mt. Ida 36
B. Plan of Zangbar and Monte Christo Leases, Darlot 54
C. Plan of Great Western Leases, Wilson's Patch 62

LIST OF MAPS.

Locality Map ... ... Frontispiece
1. Geological Sketch Map of Lawlers (20 chains to 1 inch) 31
2. Geological Sketch Map of Sir Samuel (20 chains to 1 inch) ... 51

LIST OF MINING PLANS.

I. Great Eastern Gold Mine, Lawlers 25
II. Never-can-Tell Gold Mine, Lawlers 23
III. Waroonga Gold Mines, Lawlers 16
VI. Vivien Gold Mine, Lawlers 15
V. Bellevue Gold Mine, Sir Samuel 48

PREFATORY NOTE.

THE Districts described in this Bulletin embrace mining centres in the East Murchison, North Coolgardie, and the Mount Margaret Goldfields, and it forms another of that series of reports which are designed to deal with those salient geological features which bear upon economic questions.

The field work which was carried out by Mr. Chas. G. Gibson, Assistant Geologist, was commenced on the 8th June and completed on the 22nd October, 1906.

In accordance with Ministerial instructions a preliminary report upon the district was prepared and submitted to the Government in the month of November, 1906.

As is the case in most of the Eastern and Central Goldfields. the rocks of the district comprise a complex of crystalline rocks of the geological age of which the district affords no clue, although all the available evidence points to their being of Pre-Cambrian (? Archæan) Age.

In a broad and general way the rocks of the district may be divided into an acidic and basic series, viz.: the Granites and the Greenstones. Economically it appears that the latter are the most important, seeing that they form the matrices of the payable auriferous reefs.

The Granites, though they occupy the larger area of the district, are not, however, the oldest rocks, for they are seen almost everywhere to be intrusive into the greenstones. In the Lawlers district, both greenstones and granites are traversed by numerous granitic and felsitic dykes. A few dolerite dykes traverse the granite of the Lawlers district.

The quartz veins of the district appear to be of later origin than the granite, and in most cases they occur at no great distance from its junction with the basic rocks. It is possible that there may be some genitic connection between the granite and some of the quartz veins. The relation between the granite and the basic rocks is of considerable economic importance, as it has an important bearing upon the future of the district. The reefs being of later date than the intrusion of the granite, it is unlikely that they will be cut off and absorbed by it, such as might have been expected had their formation preceded the intrusion.

In the district described by Mr. Gibson there is a marked absence of those laminated quartz and jasper veins which make such a pronounced feature in many of the more important Goldfields of the State.

The district under review has returned, up to the end of 1906, 581,104.61 fine ounces of gold, of which 4,441.26ozs. have been derived from alluvial deposits.

Full descriptions, illustrated in many cases by plans and sections, are given of such of the active mines as occurred in the district embraced by Mr. Gibson's field work. The abandoned workings, however, do not of necessity imply that the deposits have been exhausted, for it is more than likely that many may be reopened and worked under more favourable economic conditions.

The photographs which have been reproduced have all been taken by Mr. Gibson during the course of his field work.

A. GIBB MAITLAND,
Government Geologist.

Geological Survey Office,
Perth, 23rd April, 1907.

The Geology and Mineral Resources of Lawlers, Sir Samuel, and Darlot (East Murchison Goldfield), Mt. Ida (North Coolgardie Goldfield), and a portion of the Mt. Margaret Goldfield.

INTRODUCTION.

Mining centres examined and mapped.—The centres examined and dealt with in this report are Lawlers, Sir Samuel, and Darlot on the East Murchison Goldfield ; Mt. Ida, on the North Coolgardie Goldfield ; and Wilson's Patch, Mt. Margaret Goldfield ; in addition to which a brief description is given of the country between these points as well as that lying between Wilson's Patch and Morgans, this embracing the district known as "The Linger and Die."

Geological Sketch Maps, on a scale of 20 chains to one inch, have been prepared of Lawlers and Sir Samuel, while small black and white maps have been made showing the positions of the principal lines of reef at Mt. Ida, Darlot, and Wilson's Patch.

Boundaries of the East Murchison Goldfield.—The East Murchison Goldfield was originally proclaimed on the 28th June, 1895, but for administrative purposes its boundaries were altered by proclamation, gazetted on the 28th March, 1902, to take effect from the 2nd April, 1902. They were subsequently further amended, and were finally proclaimed and gazetted on 1st March, 1907, being thus defined :—

> **Bounded by lines starting from the 199 mile post on the No. 1 Rabbit-proof Fence near Wyemandoo Hill; thence north-easterly along the Rabbit-proof Fence to the 265 mile post; thence east about 10 miles and north about 35 miles to the 302 mile post; thence along the fence north-north-easterly to the 326 mile post; thence east 338½ chains and north 441 chains to the 333 mile post; thence north-easterly along the fence to the 26th degree of south latitude near the 403 mile post on the fence; thence east about 111 miles; thence south along part of the west boundary of the Mt. Margaret Goldfield about 154 miles, passing through a point nine miles west of the Trig. Station J. H. R. 58 on the summit of Mt. Waite; thence west through survey mark A.N. 62 about 62 miles; thence south through the 24 mile post on the Lawlers to Leonora telegraph line about 23 miles to a point about six miles east of Trig. Station E57, Peperill Hill; thence west to Peperill Hill, and westerly about 134 miles to the starting point.**

Early History of the East Murchison Goldfield.—Very little of the early history of this goldfield has been officially recorded.

In 1894 gold was found at Darlot and Lawlers, and on 28th June, in the following year, the East Murchison Goldfield was proclaimed, and Mr. A. G. Clifton appointed Warden, with his headquarters at Lawlers, the administrative centre of the field.

The first gold mining lease was applied for in August, 1895.

In April, 1895, gold was discovered at Lake Way.

The first crushing plant on the field was erected on the Great Eastern (East Murchison United) at Lawlers in 1896.

The first mail service was established in October, 1895, being bi-monthly from Cue to Lawlers and Darlot by camels; it was subsequently increased to weekly.

The townsite of Lawlers was surveyed and proclaimed in 1896.

Batteries were erected on the Bellevue, Sir Samuel, in 1897, and at Lake Way and Darlot in the following year.

The telegraph line from Menzies was completed in 1897, and in the following year additional batteries were erected at Lake Way, Lawlers, Darlot, and Wilson's Patch. The telegraph line to Sir Samuel and Lake Way was completed in 1900.

Previous observations on the Geology of the field.—Not much is known geologically of the East Murchison Goldfield, no detailed examination having been made of any of the district by any member of the Geological staff prior to 1906. A report by Mr. F. Reed, (*a*) and another by Mr. Blatchford (*b*) are about the only official reports made.

Mr. Reed states in his report that the country consists of foliated granite gneiss and massive and banded diorites covered with Desert Sandstone, and deposits derived from the gradual disintegration of these rocks.

Mr. Blatchford's observations show that granite is the staple formation of the East Murchison Goldfield, and that this

> has been invaded by dykes and masses of some basic rock together with a much later series of intrusions of acidic rocks which usually form narrow, tortuous dykes. . . . Near the junction of the basic rocks and the granite, a strong development of horndlende, mica, and iron-bearing quartz schists are of frequent occurrence. These schists are seen to pass gradually into granite in such a way as to suggest that they may be merely highly metamorphosed forms of the latter. The crystalline rocks are covered by sandstones, quasi-vitreous sandstones and conglomerates which have been classed inferentially as of Mesozoic Age. Of a much newer date than these are the deposits of ironstone gravel which cover such an extensive area of country. (*c*)

(*a*) The Geological Features and State of Mining in the Lawlers and Sir Samuel Districts. F. Reed. Report of the Department of Mines for 1896. Perth: By Authority, 1897. pp. 33-35.

(*b*) The Country at the heads of the Murchison and Sandford Rivers. T. Blatchford. Annual Report of the Geological Survey for 1898. Perth: By Authority, 1899. pp. 36-50.

(*c*) T. Blatchford. *Loc. Cit.*

Writing of the Sir Samuel centre, Mr. Blatchford says :—

> The Mount Sir Samuel mining centre is situated at the southern end of the Violet Range, immediately to the north of Lake Miranda. Stretching from Lake Miranda northwards, the Violet Range extends as far as the Jones Creek; and consists of a succession of semi-detached hills, the culminating point being Mount Goode, which rises to an altitude of 350 feet above the surrounding country. Geologically this Range is a diorite boss, occurring in massive granite, of a similar nature to the granite of Lake Way. . . . . Breaking through the diorite boss, usually in an east and west direction, are numeroùs granite dykes of apparently a later age. These dykes vary in thickness from a few inches to several feet. They are particularly conspicuous on the sides of Mount Goode, where they can be traced for considerable distances. In close association with these dykes are some very large quartz reefs, which latter, as far as surface indications show, follow the strike of the dykes with great persistency.
>
> At McDonough's Lookout, another apparently disconnected diorite boss is found, with numerous granite dykes intruding and the associated quartz reefs. The granite dykes in this locality are coarse grained, and can clearly be seen to consist of quartz, orthoclase felspar and mica. The mica, however, occurs in two forms, the Muscovite (common white mica), and Lepidolite (lithia mica).
>
> The quartz reefs at McDonough's Lookout are of the white opaque barren variety, and will scarcely recommend themselves to prospectors. Included in the quartz are large irregular mangano-ferruginous nodules in considerable quantities. . . . In addition to the reefs associated with the granite dykes, other quartz reefs are found in the massive diorite. These latter, for the most part, though sometimes rich in gold, are lenticular, and too expensive to work or prospect for in the hard diorite rock. Besides the quartz reefs, there is one example of a fissure lode being worked, viz., at the Belle Vue Mine. (*a*)

The following table shows the returns in fine gold from the whole of the Lawlers District (including Lawlers, Sir Samuel, Wiluna, Darlot, etc.) up to the end of 1906 :—

Year.	Alluvial.	Dollied and Specimens.	Ore crushed.	Gold therefrom.	Total Gold.
	ozs.	ozs.	tons.	ozs.	ozs.
Prior to 1897 ...	...	...	1,467·00	2,327·16	2,327·16
1897	564·03	384·60	11,763·00	18,114·81	19,063·44
1898	551·74	980·86	31,845 24	30,280·17	31,812·77
1899	1,432·35	1,210·81	40,476·25	36,021·88	38,665·04
1900	645·33	231·09	56,744·00	55,463·89	56,340·31
1901	175·22	384·54	84,433·45	64,782·43	65,342·19
1902	322·00	1,733·97	187,741·25	73,631·94	75,687·91
1903	527·66	336·37	154,080·50	83,874·13	84,738·16
1904	186·47	383·56	183,386·70	77,973·88	78,543·91
1905	28·55	56·09	175,446·00	68,147·88	68,232·52
1906	7·91	23·23	181,504·82	60,320·06	60,351·20
Total ...	**4,441·26**	**5,725·12**	**1,058,898·21**	**570,938·23**	**581,104·61**

(*a*) T. Blatchford. *Loc. Cit.*

LAWLERS.

(With a Geological Sketch Map No. 1).

General.

This town, which is the administrative centre of the East Murchison Goldfield, is situated about eighty miles north-west of Leonora, to which it is connected by coach, and which is the nearest point on the railway line.

The town is situated on a plain, practically surrounded on three sides, at a distance of from two to three miles, by low rough hills rising to a height of from one to three hundred feet, and which run round from north-west through north and east to south-east, and again between west and south-west, the balance being occupied by level plains which extend away as far as the eye can see.

A couple of fair-sized creeks (dry) emerge from these hills and trend across the plains, their general fall being in a south-westerly direction. A few fair-sized white gums grow along the banks and in the beds of these creeks, and are the only trees of any size in the district, the whole country being sparsely timbered with stunted mulga, from which the few trees that were large enough have long since been cut for mining purposes.

General Geology.

Broadly speaking, the rocks of the Lawlers district can be divided into two main classes, the granites and the greenstones, of which the latter are of by far the greater economic importance, as it is only in connection with these that the payable auriferous reefs are found. Of the area examined and mapped, the greater portion is occupied by the greenstones, the granite occupying the central portion and opening up southerly and south-easterly into the main body, which extends almost across to Leonora.

Traversing both the granite and the greenstones are large numbers of felsitic and granitic dykes, occurring for the most part close to the junction of the two classes of rocks and appearing to be of much later origin than the main body of granite. In addition to these dykes, there are a few newer basic (dolerite) dykes occurring within the granite area. A large portion of the area under examination is covered with a varying thickness of recent superficial deposits, consisting for the most part of loose sandy soil; this hides all detail, and renders accurate mapping at times almost impossible.

The Greenstones.—As stated above, these occupy the larger portion of the area mapped, and are of the type usually found on the West Australian Goldfields. They occur both massive and foliated, and vary in microscopic characters from a dark, fine-grained, compact rock through all stages to a very coarsely crystalline hornblende rock showing crystals up to nearly half an inch in length; many of these varieties appear as hand specimens to be totally different rocks, but when examined under the microscope they are seen to consist merely of locally altered forms of one and the same species. Sections of typical examples show them to consist of pale green and colourless hornblende (actinolite and tremolite) and plagioclase felspar (the hornblende generally being a little in excess) in varying stages of alteration and decomposition; a little magnetite is usually present as well. One specimen [7105] taken from a spot about half a mile north-west of the British American, G.M.L. 714, differing slightly in appearance from the average, is seen under the microscope to consist almost entirely of colourless hornblende (tremolite), only a very little of the pale-green variety (actinolite) being present, and practically no felspar.

This greenstone belt has at Lawlers a width of some fifteen miles, and appears to be continuous northerly through Sir Samuel, though the greater part of the country in this direction is covered with a considerable thickness of recent deposits completely hiding the underlying rocks.

These recent deposits commence a little south of the Vivien (Harris') and run west, north, and east indefinitely. The hills which surround the townsite of Lawlers are for the most part formed of these greenstones, and are generally very hard and unweathered, except in the neighbourhood of the Empire leases, where considerable alteration has gone on, and the greenstones are, on the surface, partly converted into laterite (ironstone conglomerate). Considerable schistosity is also noticeable in the greenstones in this locality, but it appears to be merely a surface feature probably due to the pressure caused by expansion from weathering.

At, and close to, their junction with the granite the greenstones are almost invariably crushed and foliated, often to a very marked extent, this crushing being parallel to the junction line, and would seem to result from the pressure caused by the intruding granite.

The Granite.—The central and southern portion of the area under examination is occupied by granitic rocks, these being a part of the granitic area extending southerly and easterly almost into Leonora.

This area is mostly flat, and covered with a shallow depth of loose sandy soil, from below which the rocks outcrop every here and there. Immediately to the north-west of the town, these flats are thickly covered with quartz rubble resulting from the gradual breaking down of numerous quartz reefs and leaders in the granite.

These granitic rocks are entirely massive, and that they are of later origin than, and intrusive into, the greenstones there appears to be but little doubt. Scattered throughout them are numerous small areas of greenstone, under which the granite can often be seen dipping on all sides; these vary a good deal in size, there being several fair-sized areas close to the town, but the underlying dip of the granite below these is not noticeable owing to the covering of recent deposits.

A mile or so south-east, and also north-east of the town, there are, however, several small areas—usually forming low hills—only a few chains each way in extent, beneath which the granite dips at a very flat angle on all sides. These small outliers of greenstone are most numerous close to the eastern junction of the two series of rocks ; some of them are shown on the accompanying Geological Sketch Map (No. 1), but a great number are too small and too irregular to be accurately delineated on a small-scale map, and, in addition, the detail is often hidden by recent deposits as well as by talus from the neighbouring hills. Several small lenticular bodies of greenstone have been met with in underground workings entirely surrounded by granite, and not appearing at all on the surface ; these were met with in the workings of the Great Eastern (East Murchison United) mine.

Numbers of long irregular arms and offshoots from the main body of granite run out in all directions into the greenstones, and, in addition to these, large numbers of acidic dykes are found near the junction of the two main bodies ; these will be more fully described on a later page.

The eastern and north-eastern boundary of the granite is by far the most irregular and broken, especially along the foot of the hills in the vicinity of the East Murchison United leases ; to the north and north-west it is much more regular and unbroken. Along the greater part of the boundary the granite can be seen dipping below the greenstones at an apparently very flat angle.

Micro sections of two specimens of the massive granite are as follows :—

> [736] A fairly fine-grained biotite granite showing slight micropegmatitic structure. The felspars are microcline and oligoclase with only a little orthoclase ; they are considerably kaolinsed and altered and a little secondary epidote is present as the result of this alteration. The biotite is in good-sized flakes, and is a good deal altered ; a little dark-coloured hornblende is also present. Small crystals and grains of magnetite are scattered throughout the section, and one or two small crystals of sphene are also present.

This specimen [7101] was obtained from about half a mile north of the Explosive Area.

[744] Hornblende—biotite granite, fairly coarse-grained. The hornblende is in large dark-green to brown flakes, and shows a parallel intergrowth with the biotite, which is also present in separate fair-sized flakes. The felspars are principally orthoclase and plagioclase (oligoclase) with a little microcline ; they are somewhat kaolinised and altered, giving rise to a little secondary epidote. Only a little quartz is present, being in the form of small grains and lumps. A few crystals of pyrites are scattered through the section.

This specimen [7112] was obtained from No. 4 level, East Murchison United G.M., Ltd.

The Acidic Dykes.—These are found most largely developed close to the junction of the granite with the greenstones, and vary from a typical coarse-grained granite through aplites and quartz porphyries to typical fine-grained compact felsites and rocks having the appearance of quartzites. They, or at least some of them, are of later origin than the main body of the granite, as they can, in many cases, be clearly seen cutting across the latter, and in one or two cases have been met with cutting through it in underground workings ; a typical instance of this is met with in the workings of the Great Eastern Lease, East Murchison United. The dykes appear to be more numerous in the greenstones, but this is only because it is often difficult to pick them out on the surface of the granite country owing partly to their close resemblance to it when weathered, and partly to the covering of sand which hides a great portion of this area.

Although the majority of these dykes are of later origin than the granite, yet a great number of those found in the greenstones appear to be merely offshoots from the main body, and as, owing to their great similarity at the surface, it is almost impossible to distinguish between the two classes, they have all been shown on the map under the one distinctive colour. They vary in width from less than a foot up to two or three chains, and can be followed on the surface for all distances up to almost a mile. The dykes have no particular strike, though a large number of them often run parallel to the junction of the granite and greenstones, and often form a regular network, and are so small and numerous that it is impossible to map them all on a small-scale map.

The Basic Dykes.—In addition to the dykes previously described, there are also a few basic (dolerite) dykes, which are found traversing the granite ; they probably also occur in the greenstones, but owing to their great similarity to the latter, they cannot be readily distinguished on the surface, whilst so far as mining operations have been carried, none of them have been met with in any of the underground workings.

The largest of these basic dykes is found intersecting the granite about a mile and a half north of the town ; it has an average width on the surface of about a quarter of a chain, and can be followed in an almost perfectly straight line for nearly two miles, running on a bearing slightly north of east and south of west. A section (738) of this rock [7106] seen under the microscope shows it to be a fairly fine-grained augite-dolerite, consisting essentially of colourless augite and felspar together with some magnetite ; the augite is in fair-sized grains and imperfectly formed crystals, and forms the greater portion of the section ; the felspar (probably labradorite) is in small lath-shaped crystals and acicular aggregates ; the magnetite is fairly plentiful and is mostly in small crystals.

Recent Superficial Deposits.—These cover the greater part of the district to depths varying from a few inches to a good many feet, and are most largely developed to the north where they form extensive flats extending for many miles north, east, and west ; they vary somewhat according to the nature of the underlying rock, where this is granite being much lighter in colour, looser and more sandy than where it is greenstone, and this distinction is often of great use in determining the nature of the underlying rock.

A little to the south-west of the Vivien (Harris') are one or two small areas of ironstone gravel (laterite) ; these are very limited in extent, and have not been shown on the accompanying map. With the exception of these few small areas, the district examined was practically free from these lateritic deposits which usually form a very conspicuous feature on the Eastern Goldfields of the State.

Ore Deposits.

Quartz Reefs and Lodes.—The deposits being worked in the Lawlers district are for the most part clean quartz reefs, only one "lode" deposit of any importance being worked, viz. : that in the Waroonga Mine. The quartz reefs are found both in the granite and the greenstones, but as a general rule it is only those in—or at the junction of the granite with—the latter that are payable. A number of very large and well-defined reefs occur throughout the granitic area, but these are, as a rule, too low in gold contents to be of any value, the principal exception being the reefs worked on the Great Eastern (East Murchison United) ; these were for the greater part of their length entirely in granite, but were also for a considerable portion of it alongside a lenticular mass of greenstone which has been caught up in the granite. The reef worked on the Queen, G.M.L. 145, is another case of a payable reef being found in the granite.

Most of the reefs at present being worked are in the greenstones, and taking them right through they may be said to be large and well-defined, with every indication of permanency ; they have, however, as a rule a marked lenticular habit, this being often very strongly developed.

The "contact" reefs at the junction of the granite with the greenstones are generally large, but often of no great length, and are as a rule more irregular and more lenticular than those entirely in the greenstones ; they consist usually of white glassy quartz generally strongly laminated. A good example of this type of reef is that at present being worked on the Caroline, G.M.L. 916.

The only lode at present being worked in the district, viz.: that in the Waroonga, is of the usual type, consisting of a belt of much crushed and foliated country rock impregnated with seams and veins of quartz; it is of large size and very considerable length.

Taking the Lawlers district right through, the reefs and lodes though large are of decidedly low grade, and in order to pay require to be worked on a large scale with cheap crushing facilities; this latter is, however, at present to a certain extent rendered impossible owing to the distance of Lawlers from the nearest railway station and the heavy cost of transport.

Alluvial Gold.—A large amount of alluvial gold has been won in the Lawlers district in past years, but the best of it appears to have been worked out, as little or nothing is being done in the way of working for it now. Most of it has been got in the hills to the north of the town and at Waroonga, these patches being originally known as McCaffrey's and Ogilvie's.

Timber.—The timber in the district consists entirely of mulga, which is rapidly becoming very scarce, both for mining and firewood purposes, and has to be brought in considerable distances by means of teams, thus adding to mining costs.

Water.—Water is plentiful throughout the district, and the supply is almost invariably fresh.

The *Mines.*

The following is a brief description of the principal mines working in the district at the time of my visit:—

The Vivien, G.M.L. 521, 408, *etc.*—This mine is situated about nine miles to the north-east of Lawlers, and supports the township of Harris'.

As can be seen from the accompanying underground plan (Plan IV.), a good deal of work has been done, and the reef opened up to a vertical depth of nearly four hundred feet, and a length of between fifteen and sixteen hundred feet.

The ore body is a pure quartz reef of great size and length, but is somewhat lenticular in habit; at the north end of the workings it appears to have died out altogether, but it is still going strong at the south end. The lenses of stone sometimes make in thickness to as much as twenty feet, but the average would probably be five to six. There are one or two small splits off the main line, as shown on the plan; these are smaller than the main reef, and will probably be found to come back into it and not to be separate reefs.

The quartz is mostly strongly laminated, and this class of stone is said to carry better values than the more solid bodies, but generally speaking, the values may be said to be fairly regular from end to end. In the upper levels the stone is "vughy" and much iron-stained, while below the No. 3 level, which marks the limit of oxidation, it is fairly heavily charged with arsenical pyrites.

The country is very soft and rotten, even in the bottom level, and full of "heads" necessitating heavy timbering ; it is a slightly foliated greenstone very much weathered and decomposed, and at the north end of the workings is much kaolinised.

The original water level is just below the No. 1 level, and the supply is good and fresh.

Table showing the Yield of the Vivien G.M. Co., Ltd.

Year.	Ore Crushed.	Gold therefrom.	Rate per ton.
	tons.	ozs.	ozs.
1901	45·50	21·75	·47
1903	6,515·00	3,308·90	·50
1904	14,855·00	10,305·24	·69
1905	14,538·00	8,300·19	·57
1906	26,058·00	8,327·81	·32
Total	**62,011·50**	**30,263·89**	**·48**

The Waroonga, G.M.L. 58, *etc.*—By reference to the underground plan (Plan III.) it will be seen that the lode in this property has been opened up to a depth of 460ft. and proved, at the No. 1 level, for a length of nearly 1,400ft. The ore body is a large typical "lode," the best values being on each wall.

The lode consists of crushed and foliated country rock impregnated with quartz, the latter often being in fair-sized lenticular bodies, these, as a rule, being very low grade, and being generally left as pillars ; the full width of the lode is about 120ft., but this is stated to be payable only on each wall ; the width of the paystone varies a good deal on both walls, averaging on the footwall from 4ft. to 6ft., while on the hanging wall it reaches as much as 20ft. ; between these two bodies of payable ore is about a hundred feet of similar formation, carrying, however, just too small an amount of gold to be payable.

In the workings south of the main shaft there is only one body of pay stone, viz. : on the hanging wall side, but just near the main shaft this splits and the values go on to both walls, those on the hanging wall being slightly the better ; in this body, however, there is a break in the values for a distance of about 200ft., going north from the main shaft, beyond this point, though the values come in again and practically run the whole length of the property.

At the surface, the whole formation was taken out in an open-cut for a width varying from 60ft. to 100ft.; here there were no defined walls to the lode, and the values were fairly regular over the whole width. In the lower levels the main shoot of gold pitches at a fairly flat angle to the north.

The general strike of the lode is slightly east of north, and it dips at an angle of about 60 degrees to the west ; the hanging wall is pretty clean and well defined, but there is no regular footwall, the lode gradually passing into foliated country rock, and the wall being defined principally by the decrease in assay values.

The foliation of the country, which is so very marked in the upper levels, dies out at a depth, and the country becomes more massive, consisting of a hard fine-grained fairly massive but good deal altered greenstone. In the upper levels the country is very soft and rotten and full of greasy "heads," or joints, necessitating extensive timbering.

The water level is about 95ft.—just below the No. 1 level—and there is an abundant supply of fresh water.

So far no sulphide worth mentioning has been met with in the workings.

The stone from the mine is at the present time conveyed by steam tram to the Company's mill at the Great Eastern (East Murchison United), seven or eight miles distant, for treatment. Seeing that the gross value of the stone is only about 4dwts., great credit must be given to Mr. Fitzgerald, the late Manager of the East Murchison United, for having worked the property at a profit during his term of office.

The mine is at present the mainstay of Lawlers, and there is no reason why it should not remain so for many years yet.

For returns see East Murchison United, page 25.

Glasgow Lass, G.M.L. 115.—A lot of work of a very irregular nature has been done on this property, but mostly at a depth less than 100ft. from the surface. A number of shafts have been sunk and a little work done from all of them. One of these shafts, an abandoned one, has either passed through, or bottomed on, a fine-grained granite, this evidently being merely an intrusive dyke, as the whole country appears to consist of a very much decomposed and altered greenstone.

Running through this and the adjoining leases is a large well-defined line of fissuring, or shearing, along which the greenstones have been much crushed and foliated, and through which occur a number of irregular quartz reefs and leaders.

The largest of these veins is near the centre of the lease, but little or no work has been done on it, as so far it has proved too poor ; it appears to be a continuation of the reef at present being worked near the south boundary of the lease.

In the present workings, which are all above water, the ore body has an average thickness of about four feet, its greatest width being about eleven feet ; it is very irregular and broken, and has no defined walls, consisting merely of a mass of rubbly quartz veins and leaders interspersed with seams of mullock (schist). The quartz leaders also run out into the walls (?) in all directions, in fact the whole country about here is full of them. In the ore body, which will probably become more solid and regular at a depth, it is only the quartz which carries gold, the schist being practically free from it.

Some of the small leaders running away from the main line are very good, but they are too small and irregular to pay to follow.

The general trend of the main line of lode is north and south, but at the north end of the present workings it takes a sharp turn east and west; it has not, however, been followed far in this direction, or it would probably be found to turn north again in a short distance ; its dip is at a very flat angle to the west.

This same ore body is also being worked at a depth of 50ft. or 60ft. on the adjoining leases on the south ; here it is said to average about two feet in thickness, and to have the same characteristics as in the Glasgow Lass.

Table showing the Yield of the Glasgow Lass.

Year.	Ore crushed.	Gold therefrom.	Rate per ton.
	tons.	ozs.	ozs.
1898	482·00	484·31	1·00
1899	236·00	145·44	·61
1900	472·00	598·64	1·26
1901	498·00	424·39	·85
1902	163 00	78·16	·47
1903	...	...	...
1904	514 00	283·57	·55
1905	469·00	216·45	·46
1906	252·00	146·24	·58
Total	**3,085·00**	**2,377·30**	**·77**

Hidden Secret, G.M.L. 887.—The same belt of crushed greenstone that runs through the Glasgow Lass also traverses this lease, and one or two small quartz leaders along this line have been worked to a shallow depth. The one being worked in July, 1906, has a strike of north and south, but is nearly horizontal, with if anything, a slight underlie to the east. The average thickness of it is about eight inches, though it sometimes reaches as much as two feet ; it differs from the reef worked on the Glasgow Lass in that it consists of fairly solid quartz. It has only been worked to a depth of about 20ft., but owing to its low underlie a fair amount of stone has been taken out between this depth and the surface.

Table showing the Yield of the Hidden Secret.

Year.	Ore crushed.	Gold therefrom.	Rate per ton.
	tons.	ozs.	ozs.
1905	73·00	175·49	2·40
1906	101·00	147·78	1·46
Total	**174·00**	**323·27**	**1·85**

Dobra Serica, G.M.L. 900.—The main shaft on this property has been sunk to a depth of 100ft., and at this level the reef has been opened up for a length of about 150ft., but as the property has only been worked by small parties not very much stone has been taken out. The reef as exposed in the workings is pretty irregular, ranging in size from a few inches up to nearly six feet, but averaging about two feet right through ; it is not solid quartz throughout, a good deal of it consisting of greenstone schist, with small seams of quartz running through it ; the general trend of the reef is about north-west with a turn to the east at the south-west and south. The country consists of slightly foliated greenstone, and is still pretty soft in the bottom level.

Table showing the Yield of the Dobra Serica.

Year.	Ore crushed.	Gold therefrom.	Rate per ton.
	tons.	ozs.	ozs.
1905	162·00	125·62	·77
1906	330·00	234·19	·71
Total	**492·00**	**359·81**	**·73**

New Holland G.M.L. 373 (*Sultan*).—The lode on this property has been worked down to water level (85ft.), and has been opened up for about a length of 150ft., but the work done has been of a very irregular and disconnected nature.

At the surface there is a large body of low-grade stone, attaining as much as 17ft. in width in places ; this has been taken out for a width of about ten feet, but the average size of the lower level stopes is considerably less than this.

The ore body is very irregular and has no defined walls, but consists merely of a belt of foliated country rock with quartz veins and leaders running all through it, these sometimes uniting into a large fairly solid body. At a depth this deposit will probably prove to be much more regular and defined. Some of the leaders are of good size and often fairly rich, but they are of no great length. One of these, about 12 inches in thickness, running off the main line was worked out, and is said to have yielded an average of about 2ozs. per ton ; most of them are too small to work individually.

The general trend of the main ore body is about north and south with a low underlie to the west. The country is kaolinised greenstone, generally very soft and rotten, necessitating a lot of timbering. The water supply is fresh.

Near the eastern boundary of the property a couple of small east and west leaders have been worked ; these were said to have been small but fairly rich.

Table showing the Yield of the New Holland.

Year.	Ore crushed.	Gold therefrom.	Rate per ton.
	tons.	ozs.	ozs.
1899	36·25	30·51	·84
1900	50·00	45·00	·90
1901	1,291·00	452·77	·36
1902	709·00	746·57	1·05
1903	1,361·00	486·28	·35
1904	246·00	131·08	·53
1905	287·00	118·71	·41
1906	105·00	99·29	·94
Total	**4,085·25**	**2,110·21**	**·51**

New Holland South.

Total	**64·00**	**22·01**	**·34**

King Edward, G.M.L. 922 (611).—Only a little work was being done on this lease, and the reef has been opened up to a depth of about 60ft., and for a length of 100ft. or so, but the work has been very disconnected.

The deposit is similar to that on the Glasgow Lass and New Holland leases, viz., a belt of crushed and foliated country rock with veins and leaders of quartz ; this body ranges from four to seven feet in thickness, and is said to carry four to five dwts. of gold throughout. The quartz leaders carry most of the gold, and it is on one of the largest of these that the work has been done. This leader runs with the main body in a north and south direction, and dips very flat to the east ; in places it bulges out to nearly two feet, and in others cuts out to a mere thread.

So far, 397.50 tons have been taken out of this leader, for a yield of 259.74ozs., an average of .65ozs. per ton, as shown in the following table :—

Table showing the Yield of the King Edward.

Year.	Ore crushed.	Gold therefrom.	Rate per ton.
	tons.	ozs.	ozs.
1902	35·00	30·68	·87
1903	...	...	...
1904	51·00	39·59	·77
1905	237·00	123·49	·52
1906	74·50	65·98	·88
Total	**397·50**	**259·74**	**·65**

Sunrise, G.M.L. 910 (*Birthday, G.M.L.* 386). The present workings on this lease are down about 90ft., and at this depth the reef has been driven on for a distance of some 100ft.; no stoping to speak of has been done from this level, but a fair amount of stone has been taken out above water level (45ft.) both by the present and by the previous owners of the property.

Where seen in the shaft, the reef is only a few inches in average thickness, but it opens out rapidly near the bottom, and along the drive averages three to four feet ; it is very lenticular, however, and makes and breaks very suddenly, sometimes cutting out to only a few inches ; when this pinching takes place, the space between the walls, which is always nearly the same, is occupied by greenstone schist, and this is said to usually carry very fair values.

The main lens of stone has a length of from 20ft. to 30ft.; a few feet from the east end of the drive this lens has pinched almost out, but it is opening out rapidly in the face, and in some old workings a little further east, it is said to have widened out to about six feet. In the old stopes above water level the reef is said to have averaged about a foot in thickness.

The quartz is very white, and shows fine gold freely throughout ; in the bottom level it is heavily charged with pyrites, this being said to carry good values.

About half way down the main shaft a small leader has gone off into the hanging wall, and judging from the behaviour of the main reef, this should be worth crosscutting for at the bottom level; so far, however, nothing at all has been done in this connection. The general trend of the reef is slightly north of east with a steep dip to the north.

The country is foliated greenstone, and is getting pretty hard in the bottom workings.

The water supply is fresh.

A few chains outside the northern boundary of this lease are several other quartz reefs which have been opened up to a depth of ten or twelve feet ; these are up to two or three feet in thickness where opened up and look very nice, but they have no length, being merely short lenses of quartz in the foliated greenstone ; these run about east and west and dip steeply to the south. They are apparently of no value, as they have been long abandoned.

Table showing the Yield of the Sunrise.

Year.	Ore Crushed.	Gold therefrom.	Rate per ton.
	Tons.	Ozs.	Ozs.
Prior to 1905	522·50	319·19	·61
1905	105·00	91·04	·86
1906	261·00	451·99	1·73
Total	888·50	862·22	·97

Bower Leases [*Lone Star, G.M.L.* 397 (*Right Bower*); *Right Bower Extd., G.M.L.* 415; *Right Bower North, G.M.L.* 539]. A good deal of work has been done on these leases in the past, but at the time the district was examined they were practically abandoned, only a small party doing a little prospecting work near the north-west end of the line.

Two main lines of reef, both of large size, run through the property on a bearing about north-west and south-east, having a very low underlie to the north-east.

These two reefs are two to three chains apart, the north-easterly one being the larger ; it reaches as much as twelve feet in thickness at the surface where exposed in an open-cut, but appears to get smaller as it is followed down; the second reef is from four to six feet thick where seen on the surface. Both reefs are of strongly laminated white quartz, and are well defined ; they can be followed for about 10 chains, and run with the foliation of the country, which is here a greenstone schist.

The whole of the country in this neighbourhood is full of small quartz reefs mostly running with the foliation of the schists, but occasionally across it ; they appear to be as a rule of no value.

A good deal of dryblowing has been done at the eastern end of the main line of reef, and from there southerly along a small gully running out of the hills, the gold evidently being derived from some of the small leaders running through the schists.

Table showing the Yield of the Lone Star.

Year.	Ore crushed.	Gold therefrom.	Rate per ton.
	tons.	ozs.	ozs.
1899	60·00	36 16	·60
1900	...	...	...
1901	44·75	46 99	1·05
1902	79·50	64·53	·81
1903	100·00	40·84	·40
1904	52·00	15.68	·30
1905	14·00	3·85	·27
Total	**350·25**	**208·05**	**·59**

Right Bower Extended, G.M.L. 415.—From this lease 1,508.00 tons were crushed for 957.74ozs., including 175.94ozs. dollied and specimens.

Right Bower North, G.M.L. 539.—This lease has yielded 15.09ozs. from a crushing of 17 tons.

Empire Group (*Never Can Tell, G.M.L.* 381; *May Be, G.M.L.* 22, etc.). These leases were formerly worked by the East Murchison United Company, who did a good deal of work on them and then practically abandoned them ; at the time the district was visited, the only work being done on them was being carried on by a small party of tributers, who were taking out a small crushing close to the surface.

From the accompanying plan (Plan II.) it will be seen that the reef has been opened up to a depth of 300ft. and for a length of 600ft., and taken right through this block it is said to have averaged from 12in. to 15in. in thickness. At the time of my visit only the first level was accessible, the mine being flooded, and in this the reef was seen to be very irregular and bunchy, some of the bunches running up to as much as six feet in thickness. These carried their size for no length, however, and were said as a rule not to carry it in depth either ; the reef often pinches to a mere thread, but it never cuts out altogether.

The gold is said to have occurred principally in vughs in the stone, and not in the stone itself, having evidently been originally associated with pyrites.

About the middle of the workings, there is a large quartz blow, some eight to ten feet in thickness, along the hanging wall of which the reef runs ; this blow, or buck reef, is said to have carried its size down into the lower workings, but was always too poor to work.

The country is a foliated and schistose greenstone, the foliations running about north-west and south-east, and dipping at an angle of about 40 degrees to the north-east; it is very soft and rotten in the upper levels, and requires extensive timbering; it is said to have been still soft in the bottom workings. The reef runs and dips with the foliation of the country.

The water supply is fresh, the water level being about 125ft. vertical, owing to the workings being on fairly high ground. There are several other small quartz reefs on the property, but no work of any importance has been done on any of them.

Gold yield from the Never Can Tell, G.M.L. 381 (transferred to the London & West Australian Exploration Co., Ltd.), 930.00 tons for 1,055.78ozs.

Gold yield from Gorrie's May Be, G.M.L. 22 (transferred to East Murchison United in 1904), 282.00 tons for 268.09ozs.

Bounty, G.M.L s. 19, 414.—This property was under extended exemption at the time the mine was visited, and not being worked the workings were inaccessible.

The main line of reef runs about north-west, its dip being almost vertical, and appears to have been only a foot or so in thickness ; the main workings seem to have been at the junction of this reef with a smaller one, this latter apparently being of no size or length.

The country rock is a fine-grained foliated greenstone, the foliation running about north-west and south-east, and is very hard in the bottom workings.

Table showing the Yield of the Bounty Leases.

Year.	Ore crushed.	Gold therefrom.	Rate per ton.
	tons.	ozs.	ozs.
1898	56·35	134·25	2·38
1899	213·00	341·50	1·60
1900	316·00	306·22	·96
1901	105·00	62·77	·59
1902	26·00	47·56	1·83
1903	67·00	93·30	1·39
1904	592·00	552·15	·93
1905	255·00	250·92	·98
1906	...	...	...
Total	**1,630·35**	**1,788·67**	**1·09**

Great Eastern (*East Murchison United, Ltd.; London and West Australian Exploration Co., Ltd., G.M.L's.* 37, 58, 62, 70, 155/8, etc.) ; Photo. 1.—No underground work has been done on these leases for some time, and a great part of the workings was inaccessible, and even in those to which access was possible, very little could be seen owing to all the stone having been stoped out.

By reference to the underground plan (Plan I.) it can be seen that there are two fairly regular main lines of reef, about a chain apart, with numerous offshoots from them ; the workings, taking them right through, have been very irregular, especially in the upper levels, where in one place what appears to have been a network of small leaders in a granitic schist, has been worked out

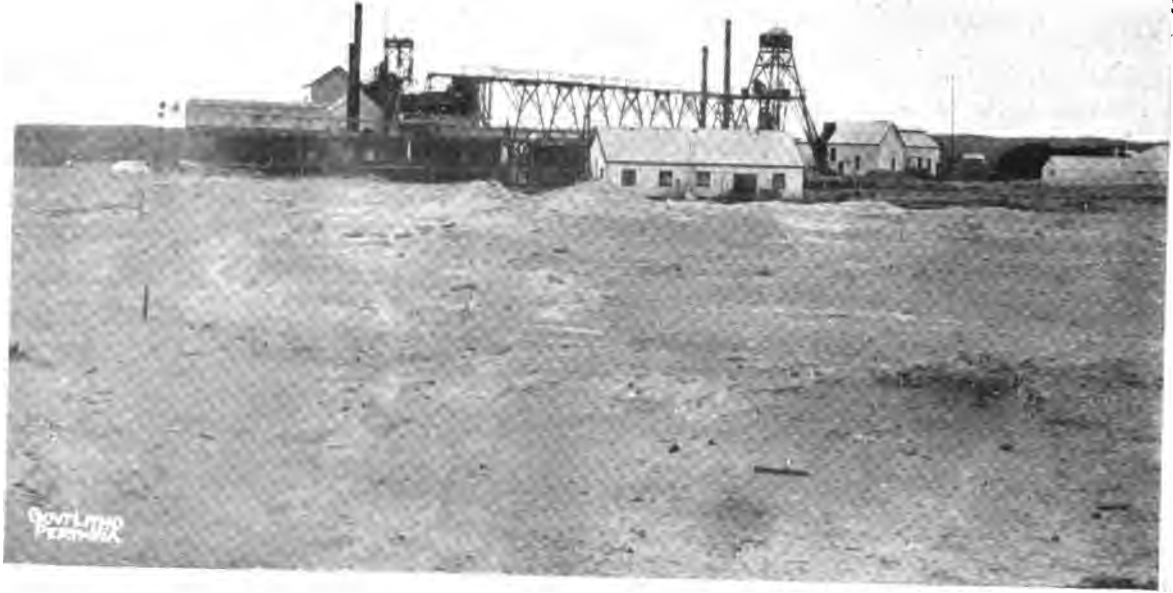


Photo., C. G. Gibson.

East Murchison United Gold Mine, Lawlers

LIBRARY
OF THE
UNIVERSITY
OF
CALIFORNIA

for a width of up to 120ft. ; this body was worked out from the No. 2 level to the surface.

The two main lines of reef, known respectively as the Lawlers and the Eastern, run about east and west, and are practically vertical with, as a rule, clean well-defined walls. These veins were somewhat bunchy, ranging in size from a few inches to a maximum of six feet, the average being said to have been about two feet ; the Great Eastern and the Lawlers veins are practically entirely in granite country, but there are numerous spurs emanating from them, which sometimes connect the two reefs ; these connecting veins have proved pretty rich, and they sometimes run off alongside lenticular masses of greenstone which have been caught up in the granite, and which, as a rule, do not reach to the surface. In these latter cases, the reefs would seem to have carried their best values only when in contact with the greenstone.

The general irregularity of the deposits seems to be due to the presence of these bodies of greenstone, several of which have been met with in the workings, and round which quartz reefs of variable size are almost invariably found.

All these reefs were very rich on the surface, but are said to have got small in the bottom levels, and the country is very hard (massive granite) ; there does not appear to be much chance of the mine again becoming payable.

There is an abundant supply of fresh water on the property.

The mine is equipped with a 40-head mill, with sands and slimes plants—which is at present engaged in crushing stone from the Waroonga and the Caroline mines—these latter being under the same management, and connected with the mill by a steam tram service.

Table showing the Yield of the East Murchison United G.M. Co., G.M.Ls. 37, 58, 62, 70, 155/8, 376/7, 381, 385, 399, 426/7., 459, 474, 500, 508/12, 552, 562/3, 573, 811, 840 (transferred to London and West Australian Exploration Co. in 1905).

Year.	Ore Crushed.	Gold therefrom.	Rate per ton.
	tons.	ozs.	ozs.
Previous to 1897	1,467·00	2,327·16	1·58
1897	8,643·00	13,748·44	1·59
1898	12,431·00	12,123·34	·97
1899	18,779·00	19,430·30	1·03
1900	19,814·00	23,622·12	1·19
1901	44,144·00	27,748·95	·62
1902	40,076·00	15,072·98	·37
1903	50,512·00	17,677·75	·35
1904	85,036·00	21,604·89	·25
1905	10,895·00	2,238·33	·20
Total	**291,797·00**	**155,594·26**	**·53**

Table showing the Yield of the London and West Australian Exploration Company, Limited (British King, G.M.L. 1, Darlot; Waroonga, G.M.L. 58, Lawlers)

Year.	Ore Crushed.	Gold therefrom.	Rate per ton.
	Tons.	Ozs.	Ozs.
1898	2,229·50	2,366·93	1·06
1899	209·00	388·52	1·85
Total	**2,438·50**	**2,755·45**	**1·13**

Table showing the Yield of the Waroonga South Leases, G.M.Ls. 62, 562, 563.

Year.	Ore crushed.	Gold therefrom.	Rate per ton.
	tons.	ozs.	ozs.
1899	435·00	275·52	·63
1900	2,455·00	1,734·84	·70
1901	1,650·00	1,559·44	·94
1902	20,231·00	6,324·00	·31
1903	17,379·00	4,435·68	·25
Total	**42,150·00**	**14,329·48**	**·33**

Table showing the Yield of the London and W.A. Exploration Co., Ltd., G.M.Ls. 37, 58, 62, 70, 155/8, 376/7, 381, 385, 399, 426/7, 459, 474, 500, 508/12, 552, 562/3, 573, 811, 840, 916, T.As. 6, 7, 8, 10.

Year.	Ore crushed.	Gold therefrom.	Rate per ton.
	tons.	ozs.	ozs.
1905	65,878·00	16,090·58	·24
1906	82,692·00	18,110·73	·22
Total	**148,570·00**	**34,201·31**	**·23**

Caroline, G.M.L. 627 (578). (*Transferred to East Murchison United in* 1906).—A large "contact" reef along the junction of the granite and the greenstones is being worked on this lease. The present workings are only down 100ft., at which level the reef is now being cut up; there is also a large open cut on the reef to a depth of about 50ft., from which a large quantity of stone has been extracted. At the top of this open cut the reef has been worked over a width of about fifty feet; it consists of clean white and somewhat glassy quartz, often strongly laminated, with occasional narrow bands of schist, and has no defined walls, *i.e.*, near the surface, small veins of quartz running out in all directions into the country. At the 100ft. level, a crosscut shows the reef to be about 20ft. wide, and to be a good deal more solid and regular than near the surface. The general trend of the reef is nearly east and west, with a steep underlie to the north; greenstone forms the hanging wall and granite the footwall ; both are considerably crushed and foliated.

The property is a decidedly low grade one, as the following table shows:—

Table showing the Yield of the Caroline.

Year.	Ore crushed.	Gold therefrom.	Rate per ton.
	Tons.	Ozs.	Ozs.
Previous to 1902	58·800	200·39	·34
1902	123·00	48·40	·39
1903	58·00	30·20	·52
1904	81·00	40·84	·50
1905	15·00	3·89	·26
Total	**865·00**	**323·72**	**·37**

Leviathan District.

The Leviathan District—or, as it is better known locally, the Fairyland—is situated some ten miles slightly south of east of Lawlers and within the same auriferous belt, close to its eastern junction with the main body of granite.

At the time of my visit (Aug. 30th) the only lease being worked was the Leviathan, G.M.L. 846; other leases in the district on which work has been done in the past are the Excelsior, G.M.L. 762 ; Excelsior North, G.M.L. 786 ; Kinglike, G.M.L. 774, and Fairyland, G.M.L. 761.

The country, generally speaking, is flat and mostly covered with a varying thickness of recent detrital deposits, so that very few reefs are found outcropping on the surface.

There is a Government well close to the Fairyland lease, from which a good supply of fresh water is obtainable.

Leviathan, G.M.L. 846.—This is a twenty-four acre block situated about two miles east-south-east from the Government well, and about twelve miles from Lawlers. At the time of my visit, it was the only lease being worked, and only two men were employed on it.

A quartz reef runs through the block on a bearing ranging between north and north-north-east; it is of fair size, and outcrops almost continuously for a length of about twenty chains, though towards the north end it is apparently a good deal broken and very irregular, and is also much smaller than at the south end.

Close to the present workings, which are situated on a slight rise and on the main line of reef, there is a very large outcrop, or "blow," of quartz some six or eight feet in width but very irregular, as these large "blows" almost invariably are. Just here there are three parallel lines of reef about 20ft. apart, the western one being the main line and the other two only extending on the surface for a short distance. All these reefs dip at a fairly flat angle to the east.

A little to the east of the main "blow" two vertical shafts have been put down, No. 1 to a depth of 100ft., and No. 2, 75ft. No. 1 which is the most easterly, has not been sunk deep enough to cut any of the reefs, but should cut the east one in another 20 or 30 feet. No. 2 shaft has been put down on the middle reef, the first part underlay and the remainder vertical, and at the 75ft. level a crosscut has been put in about 30ft. to cut the reef, and about 40ft. of driving has been done on it; the west (main) reef comes into the shaft near the bottom and cuts out altogether in the shaft, but makes again in the bottom of the crosscut, where it is some 18 inches in thickness. The reef on which work is being done at present is irregular and bunchy, being about 12in. in thickness at the crosscut, 5ft. a little farther north, 4½ft. in the north face of the drive, and 3ft. in the south face. The quartz is for the most part white and glassy and often laminated, with thin seams of chlorite along the cleavages; it carries a little pyrites at depth, and is a good deal ironstained near the surface; a little metallic bismuth and oxide of bismuth is also present in places, and when this occurs the gold contents are said to be usually higher; this bismuth will prove troublesome when the stone comes to be cyanided, and will considerably detract from the value of the tailings.

As a whole the gold contents of the stone are said to vary a good deal, some patches being very good, whilst others again are just the reverse; the stone at present opened up is expected to average about 10dwts. per ton. A parcel of about thirty tons obtained in sinking the first part of the shaft is said to have been crushed for an average yield of about 5dwts.

The country is a foliated greenstone, the foliation running about north and south, and is very soft and rotten, and will require heavy timbering below water. Insufficient work has been done on the property to thoroughly prove the value of the main line of reef, which although of considerable length is very irregular both in size and gold contents; the lenticular character which is noticeable in the workings is also present at the surface, and it is difficult to form even an approximate estimate of its average size; generally speaking, it is decidedly low grade, and not likely to prove of much value to its owners as long as it is worked under existing conditions.

The official returns from this lease to end of 1906 are 51.00 tons for 15.28 ozs.

Excelsior, G.M.L. 762.—On this property three lines of reef about a chain apart have been worked, but not much has been done on any of them. These reefs strike about east and west, and dip at a fairly flat angle to the south; owing to the covering of recent deposits it is impossible to follow them on the surface, and the workings have not proved them for more than three or four chains. Most of the work has been done on the middle reef, which has been opened up to a depth of about 100ft; the shaft however at the time of my visit had been filled in and the workings were inaccessible; there appeared to be from 100 to 150 tons of stone at grass at this shaft; this reef at the surface was about 2ft. in thickness, and the quartz was very glassy and a good deal ironstained. The south reef has also apparently been worked to a depth of about 100ft., but the main underlay shaft on this has been filled in; the reef where visible near the surface is about 2ft. in thickness. The north reef appears to have been the smallest, and not much work has been done on it. Altogether on this lease there are probably a couple of hundred tons of stone at grass, evidently too low grade to be of any value.

From information received subsequent to my visit, it appears that the stone crushed was obtained from a small rubbly quartz leader along the footwall of the main reef, and that this (the leader) cut out at a depth of about 90ft. The stone in the main reef is said to be of no value.

The total returns up to the end of August, 1906, are 30 tons for a yield of 53.85ozs.

Excelsior North, G.M.L. 786.— On this lease an underlay shaft has been put down to a depth of 50 or 60 feet on a small east and west quartz reef, dipping pretty flat to the south. Apparently very little work has been done from the shaft, and only a couple of tons of stone are at grass. The property was undoubtedly abandoned owing to the poor quality of the stone. No stone has been crushed from this lease.

Kinglike, G.M.L. 774.—No work worth speaking of has been done on this lease, and no stone has been crushed.

Fairyland, G.M.L. 761.—The only work done on this block consists of a shaft down some 50ft,. from which about 12 tons of low grade stone has been raised. The workings were inaccessible, but the reef, which runs east and west and dips south, appears to have been not more than 12 inches or so in thickness. There has been no stone crushed from the lease.

In conclusion, I am of opinion that this district is a poor one, and not likely to prove of any great importance. Prospecting will always be rendered difficult owing to the recent deposits which cover the greater part of the district and beneath which the reefs are hidden. The reefs, judging from those prospected, are irregular and very low grade, and the east and west reefs, of the class opened up on the Excelsior leases, are apparently of no value at all.

The nearest public crushing plant at the present time is Smith's Battery, near Lawlers, and about fifteen miles from the Leviathan.

Table showing the total Gold Yield from the Leases at Lawlers (other than those already given) up to the end of 1906.

Name of Lease.	No. of Lease.	Ore crushed.	Gold therefrom.	Rate per ton.
Admiral Dewey	338	68·00	65·71	·96
Bounty Extended	443	15·00	4·02	·27
Brilliant	532	3,648·00	2,600·94	·71
Brilliant Leases	532-3	7,521·00	4,681·02	·62
British-American Alliance ...	714 (634)	117·00	*134·35	1·14
Caroline Baker...	348	9·00	9·43	1·05
Cinderella	384	419·75	545·85	1·30
Do.	645	1,817·00	854·39	·46
Do.	453 (384)	1,118·00	840·74	·75
Commonwealth	482	189·00	113·01	·59
Connaught	493	13·00	11·88	·91
†Donegal	376	38·00	69·73	1·83
Donegal North...	410	206·00	215·16	1·04
Dreyfus	407	25·00	22·04	·88
Eastern United Extended ...	377	106·00	69·72	·65
Excelsior	762	30·00	53·85	1·79
Esmeralda	599	303·00	119·38	·39
Forsaken	359	35·50	18·00	·50
Great Eastern Extended ...	16	8·00	20·98	2·62
Harpur's Hill	91	108·00	50·63	·47
International	251	705·50	1,249·82	1·77
Kannuntoo	882 (460)	66·50	122·61	1·84
Kinambla Wealth of Nations	177	5,396·00	5,011·71	·92
Kaira	721	90·00	45·91	·51
Leinster Leases	15, 493	13,022·50	26,673·46	2·03
Leinster North...	467	14·00	30·52	2·18
Lillian	888	100·00	46·19	·46
Lone Hand	390	268·10	372·57	1·39
Mark Twain	733	90·00	65·81	·73
Melbourne	606	90·00	65·81	·73
Mikado	471	10·00	1·94	·19
Mt. McAuley	483	30·00	6·17	·20
New Woman	858	342·50	315·30	·92
New Woman Leases	78, 320	896·30	944·05	1·05
New Woman South Extended	331	196·85	323·11	1·64
Pick Me Up	391	12·00	4·79	·39
Plum	912	103·00	81·88	·79
Puzzler	650	34·00	24·90	·73
‡Quartzite King	459	119·50	92·47	·77
‡Queen	385	1,252·00	623·25	·49
Rajah Leases	889, etc.	1,783·00	756·74	·42
Surprise	519	615·00	235·68	·38
Victor	882	164·00	54·38	·39
Vivian Gem	908	505·00	259·65	·51
Vivian View	822	23·00	18·62	·81
Wait a Bit	393	128·20	32·63	·25
Waroonga North	603 (482)	690·00	273·03	·39
Waroonga South Extended ...	218	209·00	193·40	·92
Yongala	907	248·00	120·06	·48
Sundry Leases	...	3,131·85	2,074·29	·66
Sundry parcels treated at Cinderella Battery ...	...	67·50	744·30	1·10
Sundry Parcels British King Cyanide Works	...	...	740·21	by cy.
Sundry Parcels Lawlers Public Battery	...	214·00	§1,000·48	4·67
Sundry Parcels Urquhart and Hayes' Cyanide Works ...	...	...	1,162·66	by cy.

* Includes 77·83 ozs. dollied and specimens. † Transferred to W.A. Expl.
‡ Transferred E.M.U. § Includes 102·94 ozs. by cyanide.

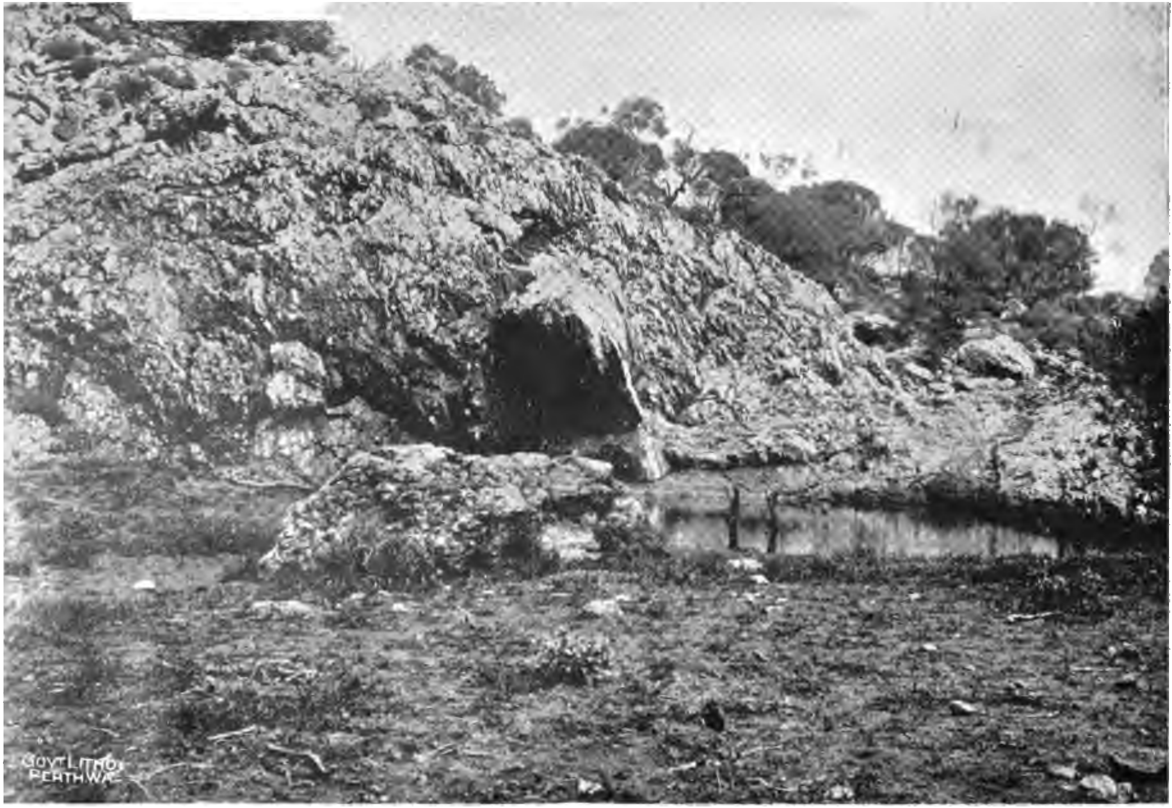


Photo., C. G. Gibson.

Quartz Outcrop, Lawlers—Mt. Ida Road.

The Country between Lawlers and Mt. Ida.

After leaving Lawlers the road (track) to Mt. Ida passes over sandy plains with occasional granite outcrops for about 14 miles, when the Pinnacles (the Sisters) are reached. The Pinnacles are two peaked hills rising 150ft. or so above the surrounding plains, and consisting of granite seamed by belts of greenstone schist, these being apparently masses which have been caught up in the granite. Passing these, the road crosses about six miles of salt marsh and then some five miles of mulga flats to Duella well. The Maroon hills, a few miles to the east of this are of weathered granite with a few small areas of included greenstone; further eastward still can be seen a long line of 'breakaways' forming the edge of a granite tableland.

From Duella Well about six miles of mulga flats are passed over, and then a granite tableland with rough ridges of weathered granite outcropping continuously for several miles; this tableland extends continuously for some eight miles, and then sandy flats till the Mt. Ida belt is reached, broken only by one granite ridge about 16 miles from Mt. Ida. Just west of where the road crosses the first tableland is a very large white quartz reef, evidently marking a main line of faulting; this reef runs for several miles parallel to the road, which is here north and south, and forms a series of bare hills sometimes 100ft. in height; these quartz hills have not in all cases any visible connection, but as they are always on the same line, it is more than probable they are continuous. (See Photo. 2.)

The whole of the intervening country between Lawlers and Mt. Ida, and as far east and west of the road as they eye can reach, consists of granite, mostly covered with loose sandy soil, and is not likely to contain auriferous deposits of any value.

MT. IDA.

General and Geology.

This centre is situated in the North Coolgardie Goldfield, some 70 miles south of Lawlers and 60 miles north-west of Menzies, this being the nearest point on the railway line.

The district was examined in 1901 by Mr. H. P. Woodward, who reported on it as follows:—*

> The geological features, from a mining point of view, are decidedly of interest, but, owing to the broken nature of the country, form a complicated puzzle to unravel until a detailed geological map of the district has been compiled. Roughly speaking, however, they may be described as a main anticlinal fold, the axis of which lies a little west of north and east of south. Of this anticlinal the arched beds have been denuded,

---

* Geological Survey of West Australia. Annual Report for 1901. Perth, By Authority: 1902.

exposing the granite core (which was evidently the cause of this contortion), upon each side of which there is a belt of crystalline rocks about three-quarters of a mile in width, which dip at a high angle upon the east to the east and upon the west to the west, and it is in these zones that the auriferous veins are met with. These belts are greatly broken by a series of cross courses and faults which prove a considerable trouble to miners, since they either throw or cut out the lodes or cause the formation of secondary veins, which are sometimes rich, but which are never continuous. To the westward and eastward of these belts is a belt of large ferruginous veins, some of which are said to carry gold, whilst beyond them are plains strewn with stones, with here and there large quartz blows.

The lodes are, for the most part, small, although they open out in places to bodies of considerable size; but, to counterbalance this, they may pinch to a mere thread of quartz or indicator for a considerable distance. The stone of the reefs carries gold throughout the so-called shoot, being that portion of the lode which is large enough to work at a profit. These vary in size, but are sometimes of considerable length. The stone in the upper levels is oxidised, but below the water level it is heavily charged with sulphides of iron and copper, the latter metal being generally associated with gold in this district.

The water supply of this district is not as a rule good, the water shaft used by the Government yielding about the best supply, whilst that at the Mt. Ida Consols is so small that, in spite of the most economical treatment, it will only supply the battery 12 hours. The water difficulty does not promise to improve with depth, since, when the sulphide zone is entered, it is found to be hard and impervious. However, when the workings are extended in the water-bearing zone to the point of intersection of the lode with a cross course, it is highly probable an abundant supply will be struck.

Timber for mining purposes is getting scarce in the vicinity of the mines, but at present there is abundance of excellent firewood close at hand.

About five miles south of the township, upon what may be probably the southern extension of the same belt, a patch of surfacing was discovered some time ago, and the deposit dry-blown, with the result that some rich parcels of gold were found. This led to the prospecting of the reefs in the vicinity, which consist for the most part of large quartz blows, all of which proved to be barren, however. Two or three smaller parallel reefs were worked, which yielded rich stone in patches, but never in sufficient quantities to pay.

The district generally is in a quiet condition owing to the fact that the miners have worked out most of the payable stone exposed in the workings left by the previous prospecting companies, and therefore require capital to proceed with dead work. Many of the properties undoubtedly warrant the expenditure of capital, and when it is borne in mind that a public battery, etc., exists in such a central position, there would be no need for a company to erect its own plant until such time as it felt warranted in doing so.

The townsite of Mt. Ida is situated on the eastern side of an extensive granite plain, rising from which, just east of the townsite, is a ridge of greenstone hills running roughly north and south for some six or seven miles, and having an average width of about a mile. This gives place on the eastern side to extensive flats, which extend as far as can be seen.

About five miles south-west of the townsite is another low range of greenstone hills trending slightly north-west and south-east, and apparently extending a good way to the westward.

Between these two sets of ridges are extensive sandy flats, except to the south, where the country is a bit more broken. These flats overlie a belt of undoubtedly intrusive granite, which extends from one greenstone ridge to the other and runs indefinitely both ways on a course slightly west of north and east of south.

At and close to their junction with this belt of granite the greenstones have been much crushed and foliated over a considerable width, the foliation running parallel to the junction line and dipping on the west to the west and on the east to the east.

Owing to the recent deposits which cover the greater part of the district and hide all detail, it is impossible to define with any degree of exactitude the width of this band of foliation, but it appears to average somewhere about twenty chains.

It is principally within this belt of foliated rock that the auriferous deposits occur, and when found in them they invariably run and dip with the enclosing schists. Quartz reefs are also found in the more massive greenstone further from the granite, but they are generally small and irregular and apparently of not much value, as little or no work has been done on any of them.

The greenstones of this district differ somewhat from most of the greenstones of the Eastern Goldfields in that they are more porphyritic, imperfect crystals of felspar up to nearly an inch across being of common occurrence. A section (745) of a specimen [7113] of this porphyritic variety, taken from the Copperfield, G.M.L. 4525, seen under the microscope shows that it consists practically entirely of felspar and hornblende ; the felspar (plagioclase) is in large porphyritic crystals, showing very little sign of crushing and only a little alteration ; the hornblende is in large flakes and masses, and is much crushed, the crushing being most noticeable along the edges of the felspar crystals ; beyond this crushing there is very little alteration of the hornblende, which is a pale green variety, probably actinolite ; a little zoisite is present in the section, and a few scattered crystals of magnetite.

A second specimen [7114] from a spot about a mile south of the Mt. Ida G.M. is not so porphyritic and shows considerable crushing both of the hornblende and the felspars, and a little more general alteration. This type appears to pass imperceptibly into the fine-grained foliated and schistose varieties, which in hand specimens are of the usual type, and which, seen under the microscope, consist of a finely granular mixture of hornblende and felspar with a good deal of magnetite, the whole showing considerable crushing, but being very little altered [7115].

These greenstones are intersected by occasional granite dykes, these being apparently merely offshoots from the main body. One or two of these dykes can be seen in the neighbourhood of the Copperfield leases, and also along the Lawlers road some two or three miles north of the township.

Ore Deposits.

Reefs and Lodes.—The ore deposits being worked through the district are principally clean quartz reefs, and lie for the most part in the belt of greenstone schist adjoining the central granite mass. As a whole, the reefs may be said to be small and somewhat irregular.

The principal lines are often of considerable length, both the Copperfield and the Timoni lines being proved for a length of 20 chains, but are invariably lenticular, sometimes bunching out to a fair size and at others pinching to a mere thread ; the lengths of these bunches vary a good deal, and in some cases they (the bunches) are so short and so frequent, the reefs are known locally as "kidney" reefs.

Associated with the quartz reefs are almost invariably found bands of talcose schist, these occurring on either wall and replacing the quartz when the latter pinches ; this schist always carries gold, but not always in payable quantities.

The reefs in the massive greenstones are, as before stated, mostly small and of no great length, and, judging from the amount of work done on them, are of little or no value. At the south end of the district and on the western side of the granite, *i.e.,* in the neighbourhood of the Copperfield leases, the country and reefs are much broken by a series of east and west faults, the line of these often being marked on the surface by large white quartz reefs which are invariably of no value ; the north and south reefs are often richer at the points where they meet these faults.

A good deal of copper is often found in the reefs, especially in those in the schists in close proximity to the granite ; this is often present in considerable quantity and naturally causes considerable trouble in the extraction of the gold. The ores of copper are usually found more in the reefs on the western side of the granite than in those on the eastern. The reefs in the massive greenstones appear to be, as a rule, free from it.

The district, generally speaking, can be said to be handicapped by no systematic development ever having been done on any of the properties ; the deepest workings are down less than 250ft., and the general rule seems to have been to get the gold out and let the development take care of itself. I am strongly of opinion that several properties now abandoned, or nearly so, would prove to be still payable if they had only been properly developed in the first place.

The district is provided with a State Battery of 10 heads, and a cyanide plant, but at the time of my visit not sufficient stone was being raised to keep the mill going full time.

The water supply of the district is fairly good, fresh water being always obtainable at a fairly shallow depth in the granite; in the greenstones, however, and especially in the schists, the supply is generally salt or brackish.

There is not a great deal of timber in the immediate neighbourhood, but a few miles out there is still an abundant supply of mulga of excellent quality.

The Mines.

The following is a brief description of the principal mines working and the work done on them at the time of my visit (August, 1906):—

Federation, G.M.L. 5035 (404).—The reef on this property has been opened up to a vertical depth of 230ft., and for a length of, roughly, 220ft., the greater part of this block to a depth of 180ft. having been taken out. The work has been, owing to the irregularity of the reef, of a somewhat disconnected nature.

The reef runs on a bearing a little west of north, and dips steeply to the west; it is lenticular in character, and pretty irregular.

Three main lenses, or shoots, as they are locally called, have been opened up in the present workings, and these all pitch to the south; they overlap each other slightly, and generally come in, or make, on the footwall side.

The values so far have not proved uniform right through, some of the stone being very poor. The size of the reef varies a good deal, being more irregular near the surface, where it attains a thickness of as much as four feet. In the bottom workings it is more regular, and averages about fifteen inches, the walls being clean and sharp, especially the hanging wall.

There is no schist associated with the reef, as is usually the case in this district, the walls being of fine-grained slightly foliated greenstone, very hard and compact in the bottom workings. On the surface this greenstone has a schistose character, but this disappears as harder country is reached, and is merely a surface feature.

At the north end of the workings the reef is cut off by a large east and west fault, marked on the surface by a large "buck" quartz reef. This reef has not yet been cut right through, but the country on the line of it is very broken and full of "heads" and cross cleavages.

There is also another of these white "buck" quartz reefs a little to the south of the present workings, and if they are continued so far it will probably be found to mark the line of another parallel fault cutting the reef off at this end also.

The present workings are about 100ft. below water level, but the water comes in very slowly, only about 500 gallons a day being bailed out ; what does percolate into the workings comes in principally along the line of the reef. There is a good deal of pyrites in the stone below water level, but very little copper.

Up to the end of 1906 the crushings from this property have been as follows :—

Table showing the Yield of the Federation.

Year.	Ore crushed.	Gold therefrom.	Rate per ton.
	tons.	ozs.	ozs.
Prior to 1902	52·00	48·33	·93
1902	122·00	191·23	1·57
1903	277·00	1,249·16	4·51
1904	627·00	1,826·70	2·91
1905	359·00	546·49	1·24
1906	126·00	176·26	1·39
Total	1,563·00	4,038·17	2·58

Copperfield and Timoni, G.M.Ls.—4525, 4583 (*Mt. Ida Consols, Ltd.*—Plate A. These were originally the two principal leases worked in this district; they had, however, at the time of my visit been practically abandoned for some years, and the workings were inaccessible owing to their being full of water.

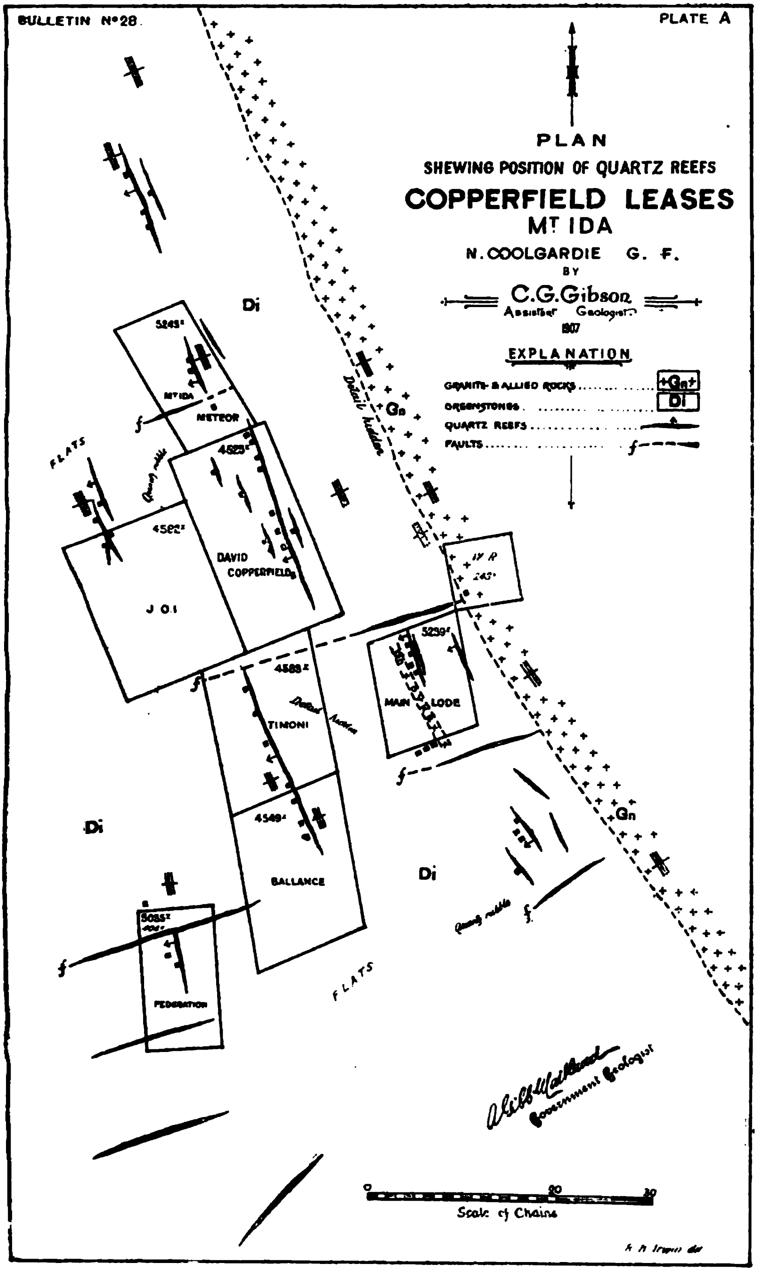
A long line of reef has been opened up on both leases, but sufficient development work does not appear to have been done to thoroughly prove either property.

On the Timoni, the reef has been taken out from the 100ft. level to the surface for a length of 1,200ft.; the only work below this seems to consist of two shafts down a further 50ft., and several winzes from the 100ft. level to about 140 or 150 feet.

On the David Copperfield lease, the reef has been worked for a length of from 300 to 400 feet from the 100ft. level to the surface, and has also been opened up for about 250ft. at the 180ft. level. No work has been done below this level. It is said that no crosscutting at all has been done on either lease, and this is especially regrettable in the case of the Copperfield, as several parallel reefs have been proved on the surface on this lease close to the main reef, and one or two small parcels of fairly good stone have been taken out of them. These reefs where seen were about 2ft. in

BULLETIN No 28.

PLATE A



PLAN
SHEWING POSITION OF QUARTZ REEFS
COPPERFIELD LEASES
MT IDA
N. COOLGARDIE G. F.
BY
C. G. Gibson
Assistant Geologist
1907

EXPLANATION

GRANITE & ALLIED ROCKS	+Gn+
GREENSTONES	Di
QUARTZ REEFS	
FAULTS	f

thickness; no indication of the size or nature of the main reef could be obtained beyond the fact that it and all the others carried a large percentage of copper, which would naturally interfere considerably with the successful treatment of the stone and detract considerably from the value of the tailings.

The total crushings from these leases to the end of 1906 are included in the returns from the Mt. Ida Consols, Ltd., which are as follows:—

Table showing the Yield of the Mt. Ida Consols, Ltd.

Year.	Ore crushed.	Gold therefrom.	Rate per ton.
	tons.	ozs.	ozs.
1899	1,603·00	3,677·35	2·29
1900	1,190·00	1,587·87	1·33
1901	2,309·50	4,748·70	2·05
1902	986·07	1,116·31	1·13
1903	1,518·28	2,345·51	1·47
1904	1,032·48	1,425·53	1·38
1905	576·50	824·99	1·43
1906	149·00	60·70	·40
Total	**9,334·83**	**15,786·96**	**1·68**

Unexpected and Unexpected North, G.M.Ls. 5177, 5222.—A belt of greenstone schist varying in width from 50 to 150 feet traverses these leases on a bearing of 145 degrees, and dips at a steep angle to the west. The belt is enclosed on either side by massive to slightly foliated greenstone.

Running through about the centre of these schists and striking and dipping with them is a small quartz reef, which consists of a series of varying sized lenses, or bunches, of quartz, ranging in thickness from a few inches up to a maximum of about 2ft., often continuous, but more usually separated by some feet of schist. The length of these lenses ranges from three or four to as much as sixty feet, this being the longest length met with so far; their depth also is just as variable as their length, and owing to this irregularity it is impossible for the prospectors to form any idea of the quantity of stone in sight, and as there is nothing to indicate when the lenses are going to cut out or make again they are very unsatisfactory to work. These lenses are, as stated before, sometimes connected by a thin seam of quartz, and at others are found slightly overlapping each other both longitudinally and vertically. Usually, however, they are separated by varying lengths of schist, and when this is the case the schist, taking the place of the quartz, is much more broken and "twisty" than that on the walls.

It is by following this "twisty" schist that the next lens of quartz is picked up; the schists on the whole are of no value, although occasionally fairly rich patches are found in them.

On the Unexpected lease several shafts have been put down on this reef to a depth of 100ft., and it has been opened up for a length of about 200ft. A good deal of stone has been taken out down to the 50ft. level, but very little below this. Along the 100ft. level, the stone is fairly continuous, having an average thickness of from 8 to 12 inches, the longest single lens met with being about 60ft. and having good values right through. Between this and the adjoining workings, down 130ft. on the north block, there is a long blank, *i.e.*, schist with no quartz, and even in these workings there is very little stone, it being almost entirely replaced by schist, and what stone there is is said to be a good deal poorer than that in the Unexpected.

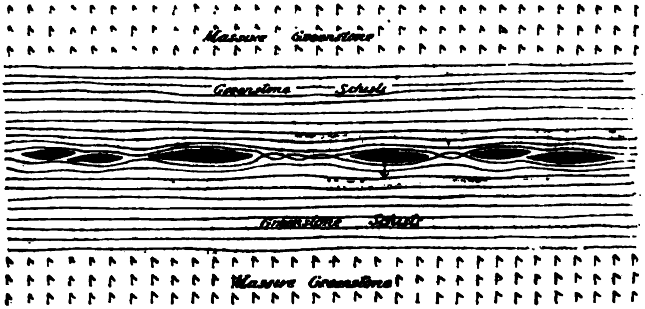


Fig. 1.—Plan showing the mode of occurrence of the Unexpected Reef, Mt. Ida.

Towards the southern end of this lease the reef appears to be cut off by an east and west fault, and has apparently been thrown three or four chains to the west, where it has been picked up again in some workings just outside the lease.

In all these workings the country—schist—is very soft and rotten and breaks away very readily, especially along the line of the reef where the "twisty" schist often comes out in large pieces.

So far no water has been met with, but it should be struck in a few feet more.

At the north end of the Unexpected North lease several shafts (now abandoned) have been put down on a small quartz reef in schist similar to that in the south workings, and which is probably a continuation of that line. A few chains farther east a little work has been done on an irregular "twisty" quartz reef, dipping west, and of fair size, but apparently very low grade, as it has been abandoned for some time.

Table showing the Yield of the Unexpected.

Year.	Ore crushed.	Gold therefrom.	Rate per ton.
	tons.	ozs.	ozs.
1904	66·00	135·97	2·06
1905	158·00	601·36	3·80
1906	239·00	614·05	2·56
Total	463·00	1,351·38	2·91

Table showing the Yield of the Unexpected North.

Year.	Ore crushed.	Gold therefrom.	Rate per ton.
	tons.	ozs.	ozs.
1905	94·00	189·56	2·01
1906	76·00	93·65	1·23
Total	170·00	283·21	1·66

Table showing the Yield of the Unexpected South.

Year.	Ore crushed.	Gold therefrom.	Rate per ton.
	tons.	ozs.	ozs.
1906	94·00	214·23	2·28

Main Lode, G.M.L. 5239 (*Pactolus, G.M.L.* 349).—At the time of my visit a little work was being done close to the surface at the north end of this lease on a good sized but irregular ore body, consisting of a couple of small quartz reefs a few feet apart separated by greenstone schist seamed with small veins of quartz, the whole carrying a small quantity of gold.

In one place this formation is replaced by about seven feet of solid quartz, but this is not continuous, and the workings are too near the surface (20 feet) and the country too broken for any correct idea to be formed of the size and nature of the deposit generally.

The previous owners of the property have done a good deal of work from 80ft. to the surface, and a little at water level, but the greater part of these workings were inaccessible.

From what I was able to see it would appear that several small parallel reefs 6 to 18 inches in thickness and a few feet apart, on the continuation of which the present workings are situated, had been worked. These reefs are in a soft decomposed greenstone schist, which in proximity to the reefs is full of small quartz seams.

The reefs run on a bearing a little west of north, and dip at fairly steep angle to the westward.

In the bottom level, the hanging wall of the most western reef worked is formed by a small granite bar a few feet in width, carrying a large percentage of biotite mica, and known locally as a "mica bar."

Beyond this is a second small quartz reef which joins with the other near the surface but is getting farther from it in depth. This reef carries a large quantity of carbonate of copper, this being apparently derived from the decomposition of the mica bar; a small parcel of stone carrying high gold values is also said to have been taken out of it.

From the nature of these deposits it appears more than likely that there are other parallel makes of stones on the east side of the main line of reef; this could easily be proved by a crosscut in the soft country, but so far it has not been done, and the property, like others in the district, has suffered accordingly.

Table showing the Yield of the Main Lode.

Year.	Ore crushed.	Gold therefrom.	Rate per ton.
	tons.	ozs.	ozs.
Prior to 1905	451·00	472·78	1·05
1905	252·00	147·98	·58
1906	226·00	90·18	·39
Total	**929·00**	**710·94**	**·76**

Mt. Ida Meteor, G.M.L. 5243.—A small party has been working on this lease and not a great deal of work has been done. The present workings are down to 100ft. (water level), at which depth the reef has been opened up for a length of about 120ft. Seen in this drive, the reef consists of a rubbly mixture of schist and quartz, with occasional fair-sized veins of solid quartz. At the northern end of the drive it is about three and a half feet in thickness, this being its greatest size ; the average thickness is about 18 inches, and the values are said to be pretty regular along the whole length.

At the 50ft. level the reef was opened up for a length of 70ft. to 80ft., but only 30ft. of this carried payable values, and this block was stoped out to the surface over an average width of about 2ft. ; no stoping has been done between the 50ft. and 100ft. levels.

The country is soft kaolinised porphyritic greenstone, slightly foliated, and with a little schist on the walls of the lode, especially the footwall ; throughout this schist there are numerous copper stains, but the reef appears to be pretty free from it.

Some work has also been done at the south end of the lease on what is apparently a continuation of the same ore body, but these workings were inaccessible.

Table showing the Yield of the Mt. Ida Meteor.

Year.	Ore crushed.	Gold therefrom.	Rate per ton.
	tons.	ozs.	ozs.
1905	198·00	191·19	·96
1906	356·00	432·45	1 21
Total	**554·00**	**623·64**	**1·12**

In addition to the above leases there are one or two others at this end of the field on which a little work is being done, but these have been opened up for only a few feet, and so far there have been no returns from them.

Rio Tinto, G.M.L. 5282 (3578).—This property is situated at the north end of the district, and on the east side of the central body of granite. A good deal of work has been done to a shallow depth, but nothing could be seen at the time of my visit. The workings are on a salt bush flat, and the whole surface is covered with a considerable depth of recent deposits ; the reef runs about north and south, and appears to, if anything, dip steeply to the east. The workings are in very soft decomposed greenstone, a good deal foliated, and appear to be very close to the junction of this with the granite, which can be seen outcropping strongly fifteen chains or so farther west.

Table showing the Yield of the Rio Tinto.

Year.	Ore crushed.	Gold therefrom.	Rate per ton.
	tons.	ozs.	ozs.
1899	250·00	344·86	1·38
1900	1,790·00	1,484·98	·83
1901	1,137·00	697·10	·61
1902	238·00	129·67	·54
1903	...	...	...
1906	91·00	126·34	1·38
Total	**3,506·00**	**2,782·95**	**·79**

Forest Belle, G.M.L. 5250 (5170).—*Formerly Mt. Ida Reward.* This property was the original Reward Claim of the Mt. Ida district, and a good deal of work has been done on it, though of a rather irregular and disconnected nature, and little or none is below water, which is 110ft. deep.

Five parallel lines of reef have been proved to exist on the property, and a little work has been done on all of them. Operations, however, have been chiefly confined to the eastern reef, which has been opened up at a shallow depth for a length of about 400ft., over which distance the stone is said to have averaged fully three feet in width.

The reefs run on a bearing of about 345 degrees, and have a steep dip to the eastward ; they are all lenticular in habit, the lenses, as usual, varying in size, but all pitching at a pretty low angle to the south.

The eastern reef, where worked, consists of a band of greenstone schist six to eight feet in average width, containing lenses of quartz of varying size and length.

These lenses sometimes entirely replace the schist and fill the whole space between the walls. The quartz alone carries payable values, and the more solid portions of the lenses are usually the best, and, as a rule, carry slightly better values along the hanging wall.

In the upper levels copper is fairly abundant, occurring principally along the walls.

The water level in the present workings is 110ft., but sulphides make their appearance at about 90ft., and in the winze below this level are very heavy. So far the water is fresh.

The country is a slightly foliated porphyritic greenstone, and, so far as at present opened up, is pretty soft and rotten. The workings are on the eastern side of the central body of granite, and are some twenty chains from its junction with the greenstones.

On the adjoining block on the north a little work is being done on the same make of stone as is being worked on this lease. On the south block a good deal of work has been done to try and pick up the continuation of the main line, but apparently without result, as the reef seems to have been cut off at this end by an east and west fault, the line of which is marked on the surface by a large white barren quartz reef outcropping a little to the east ; the strike of this is, roughly, 250 degrees, being exactly the same as those at the south end of the field.

Table showing the Yield of the Forest Belle.

Year.	Ore crushed.	Gold therefrom.	Rate per ton.
	tons.	ozs.	ozs.
1899	259·00	281·59	1·08
1900	941·00	1,112·21	1·19
1901	575·00	416·83	·72
1902	90·00	51·06	·55
1903	401·00	294·55	·73
1904	198·00	220·85	1·11
1905	440·00	345·64	·78
1906	290·00	217·62	·75
Total	3,194·00	2,940·35	·92

Forest Belle North, G.M.L. 5221.—This lease has crushed 193.00 tons for a yield of 99.79ozs., being at the rate of .52ozs. per ton.

The Ida *(formerly part of Anglo Continental Gold Syndicate, Ltd., G.M.Ls.* 36, etc.), now Battery Reserve 8696. At the time of my visit this property was being worked by a small party of tributers who were working at a depth of about 170ft., near the south end of the lease ; not much work had been done here, and only about 100 tons of stone had been taken out.

The lode as seen in these workings consists of about ten feet of greenstone schist, with veins and lenses of quartz running through it. Some of these bodies of quartz are of fair size, the largest being about three and a half feet in thickness. Throughout the present workings the quartz is said to have averaged about 2ft. ; the best values are found in the quartz, but taking the whole formation right across (quartz and schist) it is said to average about 10dwts.

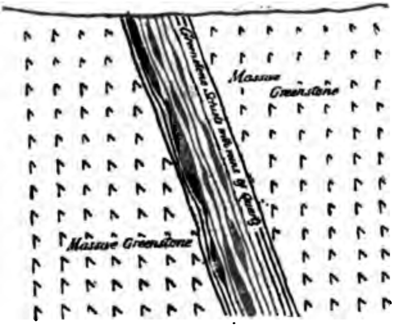


FIG. 2.—Section showing the mode of occurrence of the lode in the Ida, G.M.L. 36.

The lode has no hard and fast walls, the schist gradually passing into the unaltered country rock, which begins to get very hard at about 140ft. (v.d.). Sulphides make their appearance below water, and are very heavy in the bottom workings.

The water level is 100ft. vertical, and the water is saltish.

The general trend of the lode is slightly west of north with a dip of about 60 degrees to the east ; it has been proved for a considerable distance on the surface, and is probably of very great length, though it is impossible to trace it on the surface owing to the covering of recent deposits, which hide all detail. The general strike of the lode is parallel to the junction of the greenstones with the granite, which lies about 20 chains to the east.

A second smaller parallel line of reef runs some 30ft. east of the main line, but appears to be of no value as little or no work has been done on it.

The original principal workings on the main lode consist of a vertical shaft 10ft. by 4½ft., sunk to a depth of 200ft., and drives from this along the lode at the 100ft. and 200ft. levels. The drive at the 200ft. level is said to be 200ft. in length, while that at the 100ft. (water level) is 500ft., most of this being south from the main shaft. Values along the bottom level were said to be too poor to pay. (This level could not be examined owing to the water being up.) Between the 100ft. level and the surface, a lot of stone has been taken out, but the stopes are not continuous. Most of the work done is on the footwall side of the lode, where evidently most of the quartz was found; the full width of the schists was not exposed in such of these workings as were accessible, but it appears to be not less than six feet on the average, and often apparently a good deal more.

As these schists are said to carry gold right through, and often in fair quantity, it appears to me that this property should be at least worth a systematic sampling with the object of working it on a large scale as a low-grade proposition, as in the past it appears that only the quartz was crushed, this being of considerably better grade than the schists.

In the upper levels both the schists and the enclosing country are very soft and rotten, and as the water has been up in the workings for some time they are in a very unsafe state, and would require a lot of timbering before much work could be done from them.

The returns as given under the Anglo Continental Gold Syndicate, Ltd., G.M.Ls. 36, etc., are 1,361 tons of ore for 1,995.70ozs. of gold, an average of 1.46ozs. per ton.

Table showing the Yield of the Mt. Ida Leases (other than those already given) up to the end of 1906.

Name of Lease.	No. of Lease.	Ore crushed.	Gold therefrom.	Rate per ton.
		tons.	ozs.	ozs.
Barton	5030	60·00	52·57	·87
Belvidere	396	49·50	25·18	·50
Boudies Nest	17	316·50	209·80	·66
Boudies Nest No. 1 North ...	5029 (347)	103·00	28·84	·28
Commonwealth	5121	145·00	84·62	·58
Currajong	448	65·00	22·28	·34
Davy Die	539	16·75	8·77	·52
Evening Star	431	31·00	9·48	·30
Federation South	5124	14·00	7·86	·56
Golden Vale	298	50·00	* 118·09	2·36
Good Hope	5167	7·00	6·67	·95
Great Mt. Ida	388	57·00	28·45	·49
Gunbower	5249	22·00	7·14	·32
Ida	36	1,445·00	1,261·44	·87
Ida Gem	5067 (355)	506·50	494·14	·97
Kurrajong	343	52·00	83·83	·65
Lady Doris	5216	34·00	12·44	·36

* Includes 76·12ozs. dollied specimens.

Table showing the Yield of the Mt. Ida Leases—continued.

Name of Lease.	No. of Lease.	Ore crushed.	Gold therefrom.	Rate per ton.
		tons.	ozs.	ozs.
Lady Doris West	5228	9·00	3·14	·35
Mt. Ida Mystery	5031 (587)	37·00	8·19	·22
Mystery	5138	201·00	129·06	·64
Nelly Bly	5028 (513)	191·00	221·07	1·15
New Chum	5172	30·00	31·01	1·33
Once More	5036	141·00	63·65	·45
Pactolus South	392	88·00	55·16	·62
Pioneer	375	50·80	8·40	·16
Pocahontas	421	34·00	20·53	·60
Sandstone	5301	68·00	103·38	1·52
Star of the East	354	28·50	24·55	·86
Stornaway Castle	361	44·00	3·82	·09
Tit Lark	540	24·00	9·60	·40
Try Again	5033 (633)	84·00	56·29	·67
Wild Rose	5292	12·00	3·37	·28
Sundry Claims	...	2,133·00	376·06	·17
Sundry parcels treated at Mt. Ida State Battery ...	...	1,506·25	1,500·31	·92
Sundry parcels treated at Mt. Ida Cyanide Works ..	...	...	1,140·23	by cy.

The Country between Lawlers and Sir Samuel.

For the whole of the distance after passing the Waroonga, the road from Lawlers to Sir Samuel—32 miles north—crosses dead level country covered with a considerable thickness of recent deposits and fairly heavily timbered with good-sized mulga. These recent deposits are from their appearance overlying greenstones all the way, the Sir Samuel workings therefore being on the continuation of the Lawlers auriferous belt.

For the last three or four miles before reaching Sir Samuel, the mulga flats are replaced by alternating low sand ridges and narrow arms of salt marsh (Lake Miranda), which continue right to the foot of the range of greenstone hills (Violet Range), on which Sir Samuel is situated.

SIR SAMUEL.

(With a Geological Sketch Map, Plate II.)

Geology and General.

General.—The townsite of Sir Samuel is situated on the west side of the Violet Range near its southern extremity, and close to the north edge of the salt marsh known as Lake Miranda.

The Violet Range consists of a series of low greenstone ridges trending north and south, and having their highest point in Mt.

Goode, which rises to a height of 300 to 400 feet above the surrounding plains. The Range towards its southern end has an average width of about a mile and extends from Lake Miranda northerly to Jones' Creek, a distance of about twenty miles. On both sides of it flats covered with recent deposits extend easterly and westerly as far as can be seen.

Lake Miranda, which runs round the southern end of the range, is a large irregular salt marsh, having here a width of some two or three miles and a trend in a general north-westerly direction; its boundaries are not well defined, and it often consists of a series of narrow arms alternating with low sand ridges.

The Recent Deposits.—These cover the whole of the country for miles east, west, and south of the Violet Range, and are often of considerable thickness. They consist principally of loose red, often sandy, soil, which is the result of the weathering of the underlying rocks *in situ.*

The sand ridges along the shore of the lake consist of this red soil, and are frequently cemented together with gypsum into a fairly hard mass, especially at the surface; in some cases the ridges consist almost entirely of a more or less powdery gypsum.

The Greenstones.—The greenstones which form the ridge of hills known as the Violet Range are of the type usually found on the Western Australian goldfields ; they are mostly fine grained and slightly foliated, the foliation running about north and south. Generally speaking they are not much weathered, and are hard right to the surface.

At the south end of the range are one or two intrusive acidic dykes running about north and south, and dipping at apparently a pretty low angle to the west. The greenstones in close proximity to these are much crushed and foliated, the foliation being parallel to the strike of the dykes.

These acidic dykes vary a good deal in their macroscopic properties, but a typical specimen of them is a fairly coarse-grained compact massive quartz porphyry. Dykes of this description are said to be fairly common towards the north end of the range.

On a small island in the lake about a mile and a-half south of the Bellevue G.M., is a patch of weathered greenstone. This rock is very porphyritic and crystals of altered felspar up to several inches in diameter occur in it; a number of these crystals which have weathered out can be picked up at the edge of the lake. The felspar appears to have undergone a good deal of chemical alteration, and small seams of secondary silica can occasionally be seen running through the crystals. An analysis of a specimen (7116) has been made in the survey laboratory by the Mineralogist (Mr. Simpson), who reports on it as follows:—

Analysis G.S.M. 7116.

Silica, SiO_2	45·90
Phosphoric anhydride, P_2O_5	·13
Carbonic anhydride, CO_2	*Nil*
Titanic oxide, TiO_2	·08
Combined water, H_2O	·13
Soda, Na_2O	2·74
Potash, K_2O	·48
Magnesia, MgO	·44
Lime, CaO	18·77
Manganese Protoxide, MnO	trace
Iron Peroxide, Fe_2O_3	2·03
Iron Protoxide, FeO	·36
Alumina, Al_2O_3	29·03
Hygroscopic Water, H_2O	·10
	100·19
Specific Gravity	3·15

The mineral agrees in all respects with the variety of Zoisite, described by Dana as Saussurite (p. 515 of Sixth Edition). As shown by the microscope this material is not perfectly homogeneous. Calculations made on the basis of the analysis would indicate that it contains about 81 per cent. of true Zoisite (H.Na) $Ca_2Al_3Si_3O_{13}$, the balance being almost wholly Albite and Quartz. It probably results from the alteration of a soda-line felspar.

Ore Deposits.

Reefs and Lodes.—The reefs in this district are nearly all normal quartz reefs, but with one or two exceptions are small and of no length. Short lenticular reefs of white glassy quartz are fairly common, but these are all apparently too poor to pay. The general strike of all the reefs is about north and south, and almost all of those which have been opened up contain copper, often in considerable quantity; their gold contents are invariably low.

The only two reefs of any size in the district are those in the Bellevue and the Vanguard leases, and these are the only two on which any appreciable amount of work has been done. They were also the only two properties on which any work at all was being done at the time of my visit.

Water.—Up till recently water for boiler purposes had been a serious matter in this district, but about the middle of 1906 the Bellevue Co. struck a plentiful supply of fresh water in a shallow well on the flat a mile or so east of the hills. Previous to this only a limited supply was obtainable from the other wells.

Close to the lake there is of course an abundant supply of salt water, but this is of no use for boiler purposes.

There are several fresh water wells near the town from which an abundant supply for domestic purposes is obtainable.

Timber.—Timber is very scarce, and has to be brought in from considerable distances, principally by means of camel teams. It consists entirely of mulga.

The Mines.

Bellevue Proprietary, Ltd., G.M.Ls. 21, 24, etc.—A reference to the accompanying underground plan (No. 5) will show the amount of work which has been done on this property, which is practically the mainstay of the district.

The mine is equipped with a 40-head battery, but as a rule only 30 of these are kept going continuously.

Water for boiler purposes is obtained from the previously-mentioned well, about one and a-half miles to the east. Salt water from the lake is used for battery purposes.

The lode at present being worked runs about due north and south, dipping at an angle of about 60 degrees to the west, and, as can be seen by reference to the plan, has been proved for a length of over 1,700ft. and for a depth of 400ft.

It consists of somewhat laminated quartz with a good deal of schist and is pretty irregular, cutting out to almost nothing in some places, and in others making into large-sized bodies of stone ; at one place in the No. 3 level it makes into nearly 30ft. of solid stone ; the average size throughout is said to have been somewhere about five feet. The values are not continuous right through, even in the more solid bodies of quartz.

At the south end of the No. 3 level, which carried farthest south, the reef twists a good deal, and is much broken and very small; in the face of the drive, however, it is opening up again, but consists principally of schist, carrying a large percentage of pyrites.

In the stopes between the Nos. 3 and 4 levels the reef varies from 4ft. to 8ft. in thickness, and consists of hard slightly laminated quartz, with bands of schist, and carrying a large amount of pyrites.

Below the limit of oxidation it is this pyrites that carries nearly all the gold, very little free gold occurring in the stone ; the best values are found where the pyrites occurs massive. A little copper is also present in the stone, this running on an average from one-third to half per cent., and as might be expected, it renders special treatment of the sands, etc., necessary. The lode as a rule has no well-defined walls, the schist passing gradually into the surrounding country, which is a very hard fine-grained and slightly foliated greenstone ; occasionally clean sharp walls are found where large bodies of quartz occur, but these are the exception rather than the rule.

All the work at present being done on the property is below the 200ft. level, and it consists to a great extent of development work at the Nos. 3 and 4 levels.

Owing to the large percentage of copper present in the stone, and the fact that most of the gold is in the pyrites, the sands from the battery require special treatment. After passing over the battery plates they pass to Wilfley tables, the tailings from which are at present being stacked for further consideration ; owing to their low value and the amount of copper present, no attempt is at the present (September, 1906) being made to cyanide them. The concentrates are dried and roasted, when they pass to grinding pans ; during the process of grinding, the copper is precipitated on the lining plates of the pans and carries the gold down with it ; this precipitate is collected and refined, and a good extraction is said to be thus obtained.

Table showing the Yield of the Bellevue Proprietary, Ltd.

Year.	Ore crushed.	Gold therefrom.	Rate per ton.
	tons.	ozs.	ozs.
1897	943·00	1,787·35	1·89
1898	7,021·00	5,800·75	·82
1899	7,205·00	4,108·13	·57
1900	8,088·00	6,802·84	·84
1901	9,915 00	9,025·76	·91
1902	15,950·00	13,039·06	·81
1903	22,675 00	15,136·66	·66
1904	41,110·00	15,540·75	·37
1905	43,620·00	15,497·41	·35
1906	38,525·00	14,067·24	·36
Total	**195,052·00**	**100,805·95**	**·51**

Vanguard, G.M.L. 339.—A large body of low-grade ore has been opened up on this lease, but very little work has been done on it below 100ft. Several shafts have been sunk, and the lode has been proved for a length of about 500ft. ; in the main workings the strike of this lode is nearly east and west, but just west of them it turns northerly and runs almost north and south with a fairly flat dip to the east. The lode near the surface consists of schist with seams and masses of quartz, but it turns into a more solid body of quartz in the deeper workings.

The present owners are now working at the 100ft. level, at which depth they have driven some 250ft. along the reef, which has ~~an average thickness of about ten feet ;~~ practically no stoping has been done at this depth, but a good deal of stone has been taken out nearer the surface.

The lode varies in size somewhat, in the east face of the bottom drive it is only some four feet, but in a shaft about 20ft. farther east it is said to be about 12ft. ; in the upper workings the schist often carries very good values, and often shows free gold, but on the whole it is patchy, and not as good as the solid quartz.

The deepest shaft on the property is down 140ft. (v.d.), and the reef has been cut at this depth, but no work done on it ; it is said to have here been about 18ft. in thickness.

The country is a fine-grained slightly foliated greenstone, very soft and rotten in the upper levels, but getting harder below water.

Water is salt, and is making at the rate of about 3,000 gallons a day.

The mine is equipped with a five-head battery and cyanide plant, but owing to the scarcity of water the battery at the present time can only run about half time.

On the adjoining south block there are one or two small north and south quartz reefs on which a few pot holes have been sunk ; these apparently are too low-grade to be of any value.

Up to the end of 1906 the crushings from this property have been as follow :—

Table showing the Yield of the Vanguard.

Year.	Ore crushed.	Gold therefrom.	Rate per ton.
	tons.	ozs.	ozs.
1898	192·00	131·63	·68
1899	347·00	202·86	·58
1900	585·00	246·06	·42
1901	740·00	241·90	·32
1902	1,557·00	522·74	·33
1903	998·00	335·72	·33
1904	1,084·00	372·32	·34
1905	1,630·00	973·73	·59
1906	1,123·00	452·14	·40
Total	8,256·00	3,479·10	·42

Table showing the Yield of the Sir Samuel Leases (other than those already mentioned) up to the end of 1906.

Name of Lease.	No. of Lease.	Ore crushed.	Gold therefrom.	Rate per ton.
		tons.	ozs.	ozs.
Bald Hill	364	42·00	16·42	·39
Calliope	367	20·00	19·96	·99
Condor	434	275·00	212·16	·77
Condor United	327	343·00	383·20	1·11
Goodenough	28	90·00	42·75	·47
Gt. Westralia	107	1,164·00	505·38	·43
Isidore	489	1,554·00	1,239·14	·79
Sundry claims	...	1,124·50	*1,076·23	...
Condor Cyanide Works ...	...	...	1,844·05	by cy.

* Includes 15·81ozs. dollied specimens.

The Country between Lawlers and Darlot.

(About 50 miles slightly North of East.)

For the first two or three miles the road passes over low greenstone ridges, and then over extensive mulga flats to the "16-mile" well. This well is in granite, which appears to come in about fourteen miles from Lawlers, and then to run continuously almost to Darlot.

From the "16-mile" well the mulga flats continue for about another four miles and then sand and spinifex to the 25-mile peg, where there is a long low granite "breakaway," and then sandy flats again ; about two miles beyond the breakaway there is a small patch of greenstone country, probably a mile or so in width, but its extent and boundaries are hidden beneath the recent surface deposits. Beyond this the flats are continuous right into Darlot, broken only by a few low granite ridges, 12 miles or so out, and by a small outcrop of greenstone some six or seven miles out, this being the commencement of the Darlot greenstone belt ; its junction with the granite is hidden, but it appears to be about seven miles from the townsite, and to run between north and north-west.

DARLOT.

Geology and General.

The greater part of the country round Darlot is flat, and covered with a considerable thickness of recent deposits, almost the only break being a low ridge of hills running about north-west and south-east some three miles north of the present townsite. This ridge of hills has its highest point in Mt. Pickering, which rises to a height of 150ft. to 200ft., and runs north-westerly and south-easterly from it for a mile or so each way.

The hills are greenstone very much weathered, and here and there altered on the surface into laterite (ironstone conglomerate) ;

on the southern side they are strongly foliated, and here and there show vertical cliff faces for a height of 20ft. to 40ft., these foliations and faces apparently marking a main line of faulting or shearing.

Northward beyond these hills the flats continue again indefinitely, broken only by an outcrop of low bare granite hills some eight miles north of the townsite. (Photo. 3.)

To the south-west, in the neighbourhood of the British King leases, are extensive low-lying salt bush flats, these being apparently the southern limit of the salt marsh which runs for a good many miles north, and is known as Lake Darlot.

Several fairly large quartz reefs outcrop on these flats, generally having an almost due east and west trend, and often running for considerable distances. They are usually of white glassy quartz, and apparently of no value, as little or no work has been done on them. The workings on the flats show the underlying rock to be a very much weathered and altered massive greenstone.

The hills to the north of the town, especially along the southern face, where the foliation is most pronounced, are full of small quartz leaders running in all directions, in addition to several larger reefs running with the foliation, *i.e.,* about north-west and south-east. These leaders frequently carry high gold values, more especially at the points at which they intersect each other, and where they come in contact with the larger main lines of reef, and a large amount of alluvial gold has been scattered about as the result of the weathering out and breaking down of these leaders.

A great deal of work has been done in the search for this alluvial, and a lot of gold was won in past years, but very little is being got now, and only about a dozen men were working it at the time of my visit.

None of the gold seems to have been more than a foot or fifteen inches from the surface.

Most of the larger reefs at this end of the field do not carry payable values right through, but exceptionally rich pockets are found in them here and there, especially at their points of contact with one or more small cross leaders.

When these pockets are met with, the stone is invariably "dollying" stone, the balance of the reef being of no value. These reefs are very unsatisfactory to work, as there is nothing to show when one of these pockets is going to occur, and until one is met with the work is all dead work. The only reef at present being worked at this end of the field in which fairly regular values are obtained is that running through the Zangbar and Monte Christo leases; this is a large fairly low-grade reef, somewhat irregular

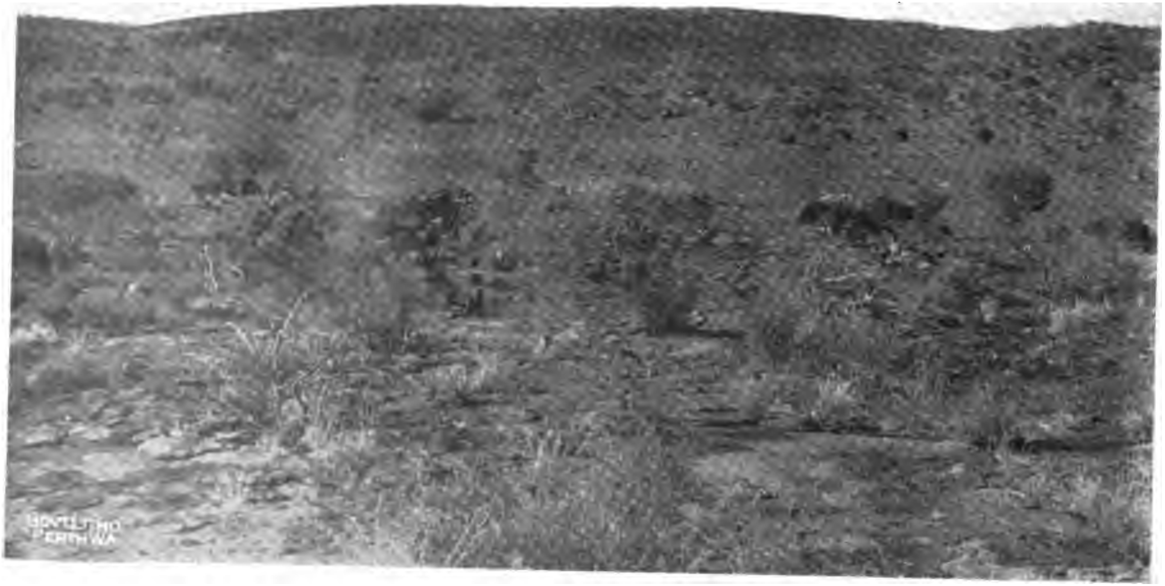


Photo., C. G. Gibson.

Bare Granite Hill, 8 miles North of Darlot.

so far, but of considerable size and length; it will be more fully described on a later page.

At the south end of the district the reefs are more regular, and the values are pretty uniform throughout, no rich pockets being found such as those which characterise the reefs at the north end.

The district is fairly well watered, fresh water being obtainable at a shallow depth at the north end; at the south end, on the apparent continuation of Lake Darlot, it is salt, and is met with in apparently inexhaustible quantity at a depth of about 30ft.

Timber in the immediate neighbourhood is scarce, but an abundant supply of good mulga is obtainable a few miles out.

The district is supplied with a ten-head State Battery and cyanide plant, situated close to the Ballangarry lease, about a mile to the south-east of the townsite.

The Mines.

The following is a brief description of the more important properties working at the time of my visit (September, 1906):—

Monte Christo, G.M.L. 648. (Plate B.) The reef on this property runs a little west of north-west and south of south-east, and underlies at a very low angle to the northward. The reef has been proved to a depth of 200ft., and at the 100ft. level has been opened up for a length of nearly 400ft. Several vertical shafts have been put down on the lease, the deepest of which has cut the reef at 200ft.

At the present time the owners are straightening up an underlay shaft, which is to be used as the main working shaft; very little stoping has been done except above the 70ft. level.

The reef varies a good deal in size, being about 2ft. thick near the surface, and as much as 11ft. at one place in the shaft near the 200ft. level; its average throughout is about six feet.

The quartz is white and glassy, very broken and rubbly near the surface, but hard and compact in the bottom level; it is sometimes laminated, when it is said to carry much better values; the cleavage faces are usually heavily coated with oxide of manganese, and a lot of talc is associated with the quartz right through.

In the drive north from the main shaft at the 100ft. level, and in the north face the size of the reef is pretty uniform, and averages five to six feet; in the south drive it is not so regular, and near the end of the drive pinches out twice to a very small body, but in the face it is making again into a good-sized body of stone. On the surface, just south from this point, the reef is a good deal broken, but gets more regular again farther south, and will probably be found to do the same at a depth.

The stone in the bottom level carries a little pyrites, and this is said to be high in gold values.

The country is greenstone, very soft and rotten as far as opened up ; it stands pretty well above water level, but is very "greasy" and slippery below, and, owing to the flatness of the reef, will require very heavy timbering.

The water level is about seventy feet, the supply was at first fresh, but at about 130ft. it began to get salt.

Table showing the Yield of the Monte Christo.

Year.	Ore crushed.	Gold therefrom.	Rate per ton.
	tons.	ozs.	ozs.
1902	17·00	24·66	1·45
1903	198·50	118·45	·59
1904	957·60	527·89	·55
1905	1,416·50	822·50	·58
1906	305·00	243·55	·79
Total	**2,894·60**	**1,737·05**	**·60**

Zangbar and Filbandint, G.M.Ls. 633, 626.—These leases are on what is undoubtedly the continuation of the Monte Christo line of reef, which is here running about north-west and south-east, and underlying at a very low angle to the north-east. (See Plate B.)

A lot of work has been done, but all at shallow depth, the deepest workings being less than 150ft. The present main shaft is down 130ft., and at 120ft. the reef has been opened up for a length of about 500ft ; practically no stoping has been done from this level. A few chains farther south the same reef has been opened up at the 60ft. level for about 200ft., and this block stoped out ; it has also been opened up for a couple of hundred feet at the north end, but not stoped ; it is here said to have averaged 4ft. to 5ft. in thickness.

The reef in the present main workings is somewhat irregular and bunchy, and probably averages about five feet in thickness, though it is a good deal bigger in places.

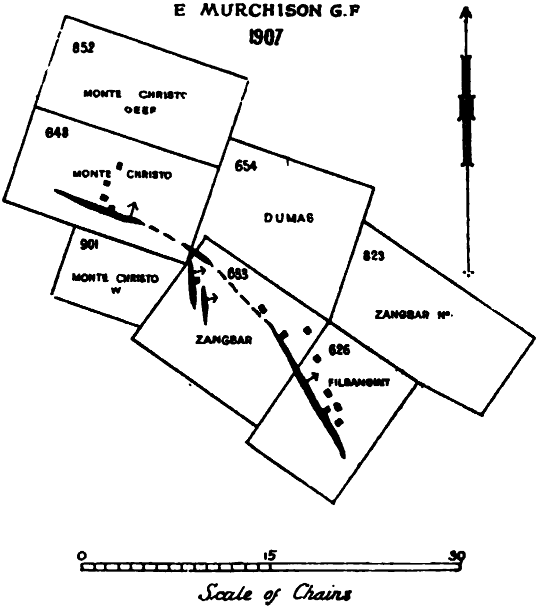
The quartz is white and glassy and usually very hard ; it is sometimes a good deal laminated, and carries a large amount of oxide of manganese on the faces, in which cases it is said to carry much better values. The walls are fairly clean, but the country is extremely soft and rotten, and owing to the flatness of the reef will require extensive timbering.

The water is so far fresh, and is being pumped at the rate of about 12,000 gallons per day ; it will probably turn salt at a little greater depth, as was the case in the Monte Christo.

The present owners have recently erected a ten-head battery, and at the time of my visit had just begun to get the mine into shipshape order.

BULLETIN No 28 PLATE B

PLAN
SHEWING POSITION OF QUARTZ REEFS
ON
THE MONTE CHRISTO & ZANGBAR G. M. Ls.
DARLOT
E MURCHISON G.F
1907



R.H. Irwin del.

The property is decidedly a low-grade one, but there is a large body of stone, and once better standing country is met with it should pay well.

Table showing the Yield of the Zangbar.

Year.	Ore crushed.	Gold therefrom.	Rate per ton.
	tons.	ozs.	ozs.
1903	91·00	31·73	·38
1904	206·50	117·03	·56
1905	699·50	353·99	·51
1906	2.565·00	935·89	·36
Total	**3,562·00**	**1,441·64**	**·40**

Table showing the Yield of the Filbandint.

Year.	Ore crushed.	Gold therefrom.	Rate per ton.
	tons.	ozs.	ozs.
1902	107·00	249·55	2·33
1903	141·50	175·92	1·24
1904	293·00	286·02	·97
1905	381·50	173·28	·45
1906	76·00	33·42	·44
Total	**999·00**	**918·19**	**·91**

St. George, G.M.L. 273.—Very little work was being done on this property at the time of my visit, though a good deal has been carried on in the past and a lot of gold has been taken out, principally from one very rich shoot, from which some 10,000ozs. are said to have been obtained.

A good-sized main line of reef runs through the lease on a bearing slightly west of north and east of south, underlying at an angle of about 50 degrees to the west, and can be plainly followed on the surface for a distance of about 15 chains; it is rather irregular in size, sometimes pinching to a few inches, while at others it bulges out to five or six feet. The quartz is very white and glassy, and taking it in bulk its gold contents are little better than traces; occasionally very rich pockets are found in it however, these usually occurring on the footwall side, and being found at the junction of the mains reef with small quartz and ironstone leaders, which run through the country in all directions, and usually at a much flatter angle than the main reef. The bulk of these leaders are not of very high value, but rich pockets—invariably dollying stone—are frequently found at their intersection with other leaders as well as with the main lines of reef, and a lot of work has been done both on this lease and on others in this neighbourhood in the search for these pockets, but as there is no indication of when one is going to occur, or of what size it will be when found, the work is of rather an unsatisfactory nature.

At the time of my visit driving along the main reef was being carried out at a depth of about 30ft. in the hopes of picking up one of these pockets, but so far without success.

Table showing the Yield of the St. George.

Year.	Ore crushed.	Gold therefrom.	Rate per ton.
	tons.	ozs.	ozs.
1897 ...	...	278·21	dollied and specimens
1898	98·50	* 392·56	3 98
1899	...	615·48	dollied specimens
1900	31·00	† 107·07	3·45
1901	...	...	...
1902	171·00	‡ 3,097·49	18·11
1903	145·50	4,912·73	33·76
1904	43·00	388·19	9·03
1905	56·50	927·25	16·41
1906	13·00	7·52	·58
Total	**558·50**	**10,726·50**	**19·20**

* Includes 277·86ozs. dollied and specimens. † Includes 59·11ozs. dollied and specimens. ‡ Includes 1,696 56ozs. dollied and specimens.

The above three properties are all to the north of the present townsite, along the line of low greenstone hills; they are the only leases at this end of the field on which any work worth mentioning is being done.

Ballangarry, G.M.L. 93.—This lease is situated on the flat, about a mile south-east of the townsite and close to the site of the State Battery.

A fair-sized quartz reef runs through the property on a bearing about north-west and south-east, dipping at a flat angle to the north-east; it has been proved for a length of some 400ft., but its extent beyond this is not known, as the outcrop is hidden beneath the covering of recent deposits. A good deal of work of a somewhat disconnected and irregular nature has been done down to a depth of 130ft., but at the time of my visit a great part of these workings were inaccessible, and a little work was being done at the north-west end of the lease.

The reef right through is very irregular in size, ranging from a mere thread up to as much as four feet, but having an average thickness of from 18 inches to 2ft.; it consists of a series of quartz lenses, these so far having an average depth of about 50ft., but varying a great deal in length; these lenses are generally separated by a foot or two of schist and overlap slightly vertically, the lower lens always coming in on the hanging wall of the one above it. (See Fig. 3.)

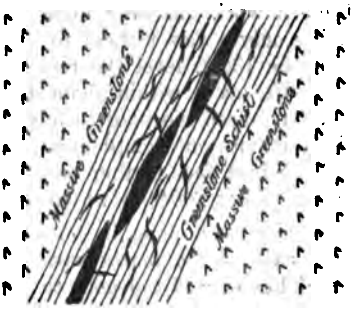


FIG. 3.—Section showing the mode of occurrence of the Ballangarry Reef, Darlot.

The quartz is a good deal broken and iron-stained, and often carries a large percentage of oxide of manganese, principally on the cleaveage faces ; a little copper is said to be also present in the stone.

The country immediately surrounding the quartz lenses is a very soft decomposed greenstone schist foliated parallel to the strike and underlay of the reef. The country gradually passes into a massive greenstone on either side, and apparently has a maximum width of 20ft. to 30ft.

A large number of small quartz stringers run in all directions through this schist, but though these often carry good values they are too small to work separately and taking them and the schist in bulk, the values are too low to pay working expenses. So far there appears to have been no defined shoot of gold, all the quartz being of fairly uniform value.

The original water level is from 60ft. to 70ft., and the supply is so far fresh.

Table showing the Yield of the Ballangarry.

Year.	Ore crushed.	Gold therefrom.	Rate per ton.
	tons.	ozs.	ozs.
1898	174·00	174 24	1·00
1899	401·00	390·18	·97
1900	...	...	...
1901	144·00	84·00	·58
1902	1,240·00	538·94	·43
1903	281·00	75·83	·26
1904	363·10	261·30	·71
1905	528·00	292·00	·55
1906	577·50	252·58	·43
Total	3,708·60	2,069·07	·55

Amazon, G.M.L. 182.—This property is also situated close to the townsite, being about half a mile to the east of it.

The main workings are down to a depth of 150ft. in very hard country ; not much work has been done at this level as the reef is too small (being only a few inches) to pay to work in hard country. From about the 130ft. level the reef has been taken out for a length of some 350ft. up to within about 40ft. of the surface; above this it is said to have been too poor to pay. At a point 150ft. west of the main shaft it cuts out completely, but has been picked up again a couple of hundred feet farther on and has been worked for a further distance of about 200ft. down to a depth of 130ft.

A little work has also been done in one or two places some 5 to 10 chains to the east of the mains workings, but as far as opened up here the reef has proved too poor to pay.

Throughout the present main workings, where the best values have been obtained, the reef, which runs almost due east and west and underlies at a fairly low angle to the north, is said to have averaged from 10 inches to a foot in thickness, while in the bottom drive in the hard country it is from 4in. to 8in, and a good deal broken, though the values are said to be just as good as in the workings above. A fairly large quantity of pyrites is also present in the stone, and this is said to carry high values. These main workings appear to be in a small area of greenstone which has resisted weathering, as the workings to the west are still in soft country at 130ft. with little or no sign of sudden hardening, and the country to the east also as far as opened up is still soft and rotten ; the greenstones are massive, with slight foliation along the line of the reef.

Table showing the Yield of the Amazon.

Year.	Ore crushed.	Gold therefrom.	Rate per ton.
	tons.	ozs.	ozs.
1898	273·50	367·94	1·34
1899	224·00	315·17	1·40
1900	108·00	189·73	1·75
1901	481·00	824·82	1·71
1902	185·00	542·68	2·93
1903	598·50	1,418·85	2·37
1904	229·00	682·55	2·98
1905	281·00	342·21	1·22
1906	119·00	325·56	2·73
Total	**2,499·00**	**5,009·51**	**2·00**

British King, G.M.L. 745.—A lot of work has been done on this property in the past, but it has been practically abandoned for some years, and at the time of my visit only a little prospecting work was going on near the surface at the east end of the lease.

The reef runs almost due east and west, and dips at a moderately low angle to the south, and has been picked up at intervals for a distance of about 15 chains; owing to the recent deposits which cover the whole country about here its actual outcrop is not visible.

The main shaft sunk by the original company is said to be down to a vertical depth of 260ft., and from 180ft. to the surface the reef is said to have been worked out for a considerable length, and to have averaged about four feet in thickness, and to have carried very fair values.

The work being done on the lease at the time of my visit was at the east end, where a trial parcel was being taken out between the 30ft. (water) level and the surface. The reef here averages about 12in. in thickness, the biggest place being about 20in., and consists of clean solid quartz with sharp well-defined walls, and runs very true.

The country in the bottom of the main shaft, as seen on the dump, consists of a fairly hard fine-grained massive greenstone, but is very soft and rotten near the surface. The water level is from 30ft. to 35ft., and the water is extremely salt, the lease being on what is apparently the southern continuation of the salt marsh known as Lake Darlot.

The property is situated about three miles west of the townsite, and was originally equipped with a stamper battery and cyanide plant, both of which have been dismantled for some years.

The returns are included in those from the London and West Australian Exploration Co., Lawlers.

Table showing the Yield of the Darlot Leases (other than those already mentioned) to the end of 1906).

Name of Lease.	No. of Lease.	Ore crushed.	Gold therefrom.	Rate per ton.
		tons.	ozs.	ozs.
A1	81	245·00	164·43	·63
A1	718	2·00	6·39	3·19
Ballangarry Extended ...	187	18·00	4·17	·32
Balmoral	628	22·00	19·14	·87
Blue Spec	919	77·00	37·88	·49
Boomerang	872	65·00	93·91	1·44
British King East	306	524·00	352·23	·67
British King North	479	18·00	12·26	·68
British King No. 1 West ...	2	470·50	550·32	1·17
Darlot Brown Hill	355	6·00	1·98	·33
East End	619	113·00	173·06	1·53
Eildon	566	12·00	5·25	·43
Fingall Reefs Extended, Ltd.	1	12,248·00	7,088·20	·57
Homeward Bound	525	23·00	18·31	·79
Homeward Bound G.M. Co.	321	83·95	183·66	2·19

Table showing the Yield of the Darlot Leases—continued.

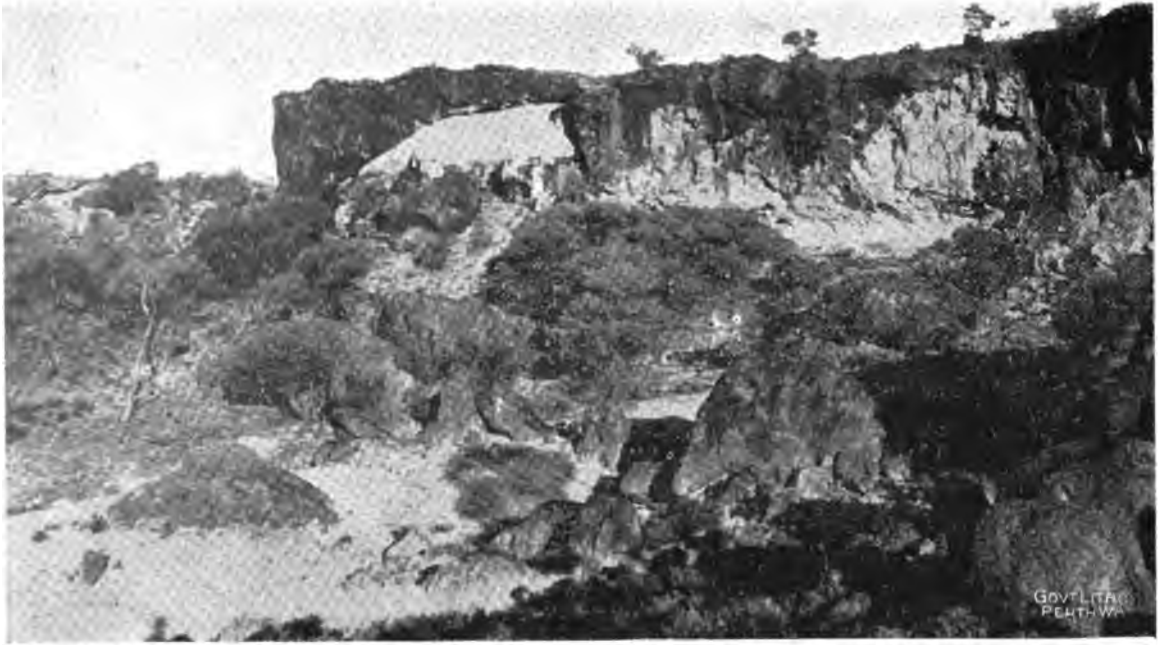
Name of Lease.	No. of Lease.	Ore crushed.	Gold therefrom.	Rate per ton.
		tons.	ozs.	ozs.
Ironclad	345	...	134·32 dollied	...
King of the East	754	824·60	496·15	·60
King of the Hills	380	33·50	93·15	2·78
King of the Hills	375 (330)	355·00	* 819·20	2·30
Kyneton	322	20·00	16·72	·83
Lass o' Gowrie	349	...	2·21 dollied	...
Morning Light	337	144·50	262·18	1·81
Morning Light	544 (337)	168·00	199·01	1·16
Mystery	685	15·00	24·61	1·64
Pride of Darlot	97	219·25	226·40	1·03
Pride of Darlot	849	24·00	11·09	·46
Rise and Shine	329	134·00	† 737·13	5·50
Rose	689	61·50	41·95	·68
Rose and Thistle	865	...	39·30 dollied and specimens	...
Royal Welshman	897	13·50	6·62	·49
Shamrock	324	5·50	8·23	1·50
Sylvia	528	23·00	8·51	·37
Waikato	363	4,370·00	5,250·73	1·20
Wee Jim	673	120·50	69·26	·57
Sundry Claims	...	1,329·44	‡ 1,186·00	...
Sundry parcels treated at Darlot State Battery ...	...	233·00	480·84	2·06

* Includes 79·35ozs. dollied and specimens. † Includes 627·70ozs. dollied and specimens.
‡ Includes 232·96ozs. dollied and specimens, and 1·16ozs. alluvial.

The Country between Darlot and Wilson's Patch.

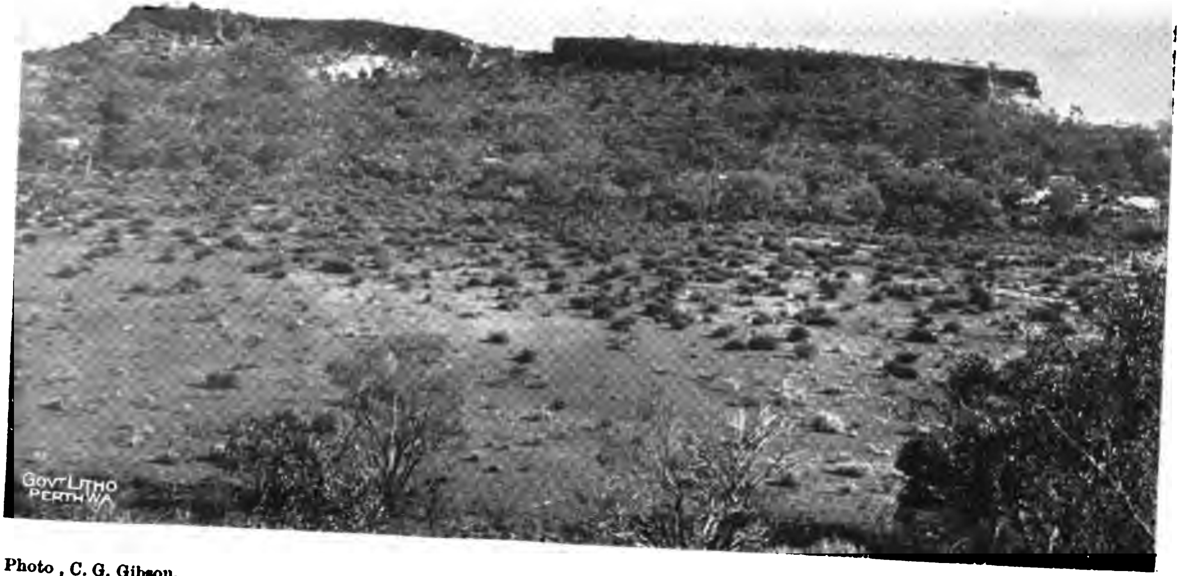
(30 miles south.)

For about ten miles after leaving Darlot the road passes over fairly thickly timbered mulga flats with a considerable thickness of recent deposits. For the first eight miles or so these deposits apparently overlie greenstones, but beyond this they become sandy and lighter in colour, and from this it may be inferred that the underlying rock is undoubtedly granite. At about the 10-mile peg there are several outcrops of rough weathered granite, this being the commencement of the large tableland which extends southerly beyond Wilson's and easterly and westerly as far as can be seen. The greater part of this tableland is covered with loose sandy soil, but there are here and there outcrops of weathered granite in the form of low rough ridges. Several large typical granite "breakaways" can be seen many miles both east and west of the road, these marking the edges of other tablelands.



Photo, C. G. Gibson.

"Breakaway" (weathered granite) Wilson's Patch



Photo, C. G. Gibson.

Table-top Hills, near Wil

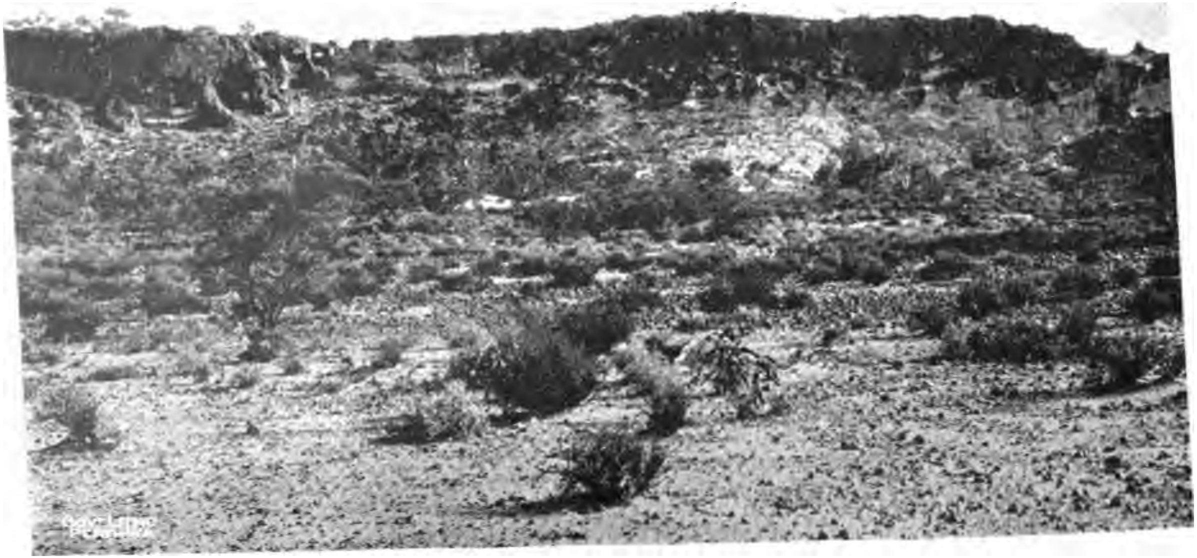


Photo., C. G. Gibson.

"Breakaways," near Wilson's Patch (being nearer view of Photo 5)

WILSON'S PATCH.

General and Geology.

The country at Wilson's Patch is essentially granite, broken by a few small outcrops of foliated greenstone, these being apparently masses which have been caught up and held in the intrusive granite. Most of these greenstone areas are of very small extent—some of them being only a few chains each way—but one or two are several square miles in extent.

The greater part of the district is flat and covered with recent deposits, which hide all detail and render it difficult to form a correct idea of the exact relationship of the greenstones to the granite. Both classes of rock are very much weathered and decomposed.

Some six to eight miles south-west of Wilson's Patch there is said to be a large belt of greenstones running about north-west and south-east and extending westerly for some miles. This is probably the continuation of the Mt. Clifford, King of the Hills, and Leonora belt; it apparently dies out at a point almost due west of Wilson's, as the country north and north-west beyond this is all granite.

Some very fine granite "breakaways" occur a few miles to the north-west of Wilson's in the neighbourhood of Chandler's Reward; Photos. 4 to 6 give a fair idea of the general appearance of some of these.

The reefs at Wilson's are found principally in the granite, and along the junction of the granite with the greenstones; they are sometimes of fair size and length, but judging by results they are of very low grade. At the time of my visit only one lease was being worked, viz.: the Great Western, the reef on this property running along the junction of the granite with a small area of greenstone. This property, as well as one or two others, will be more fully described on a later page.

Most of the reefs run almost due east and west, and are practically vertical. The quartz is for the most part white and glassy, and strongly laminated; it often carries a fair percentage of galena and sometimes a little zinc blende.

Small quartz leaders are common all through both the granite and the greenstones, running in all directions; these sometimes carry high gold values, but are usually too small to pay to work separately.

A lot of alluvial gold has been scattered about as the result of the weathering out and breaking down of these leaders, and a lot of work has been done in the search for it. All the best patches appear to have been worked out, and little or nothing is being done in that line now; most of the gold appears to have been got at a depth of only a few inches below the surface, and nothing very big is said to have been found.

The district appears to be fairly well watered, most of the wells yielding drinkable water, though some of it is not too good; the best water is at present being obtained from the Government Well on the flat, about a mile north of the townsite; here a fairly good supply is met with at a depth of 70ft. to 80ft.

Timber sufficient for all requirements is obtainable within a radius of a few miles.

Mines.

Great Western, G.M.L. 696.—(Plate C.) A good deal of work has been done on this lease, and the mine is equipped with a ten-head battery, cyanide plant, etc., this being the only battery in the district, the next nearest being at Mt. Clifford.

The reef has been opened up at the 130ft. and 230ft. levels, at the former for a length of between 600ft. and 700ft., and at the latter for about 400ft.; most of the stone above the 130ft. level has been taken out, but not much below this.

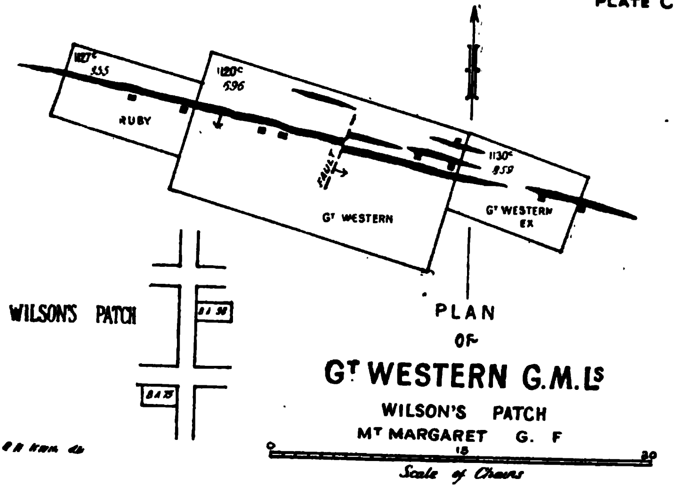
The reef runs on a bearing a few degrees north of west and south of east, and underlies to the south, being fairly flat near the surface, but almost vertical in the lower levels. As can be seen by the accompanying plan (Plate C.), it has been traced on the surface for a considerable distance on a fairly regular bearing. The reef is very irregular, both in size and nature, having, in the upper levels, no defined walls, and varying in thickness from a few inches up to six and eight feet.

Small quartz leaders and droppers are continually running off into the walls from the main reef, and the whole country near it is full of these.

The main reef appears to consist of two separate makes of quartz, with a few inches of mullock between them, the footwall stone always carrying the best values. A little east of the main shaft these two makes of stone appear to split and run one on either side of a small lenticular mass of greenstone enclosed in the granite; the stone on the south side of the greenstone, *i.e.*, the hanging wall reef, carries no values, but the other is fairly high grade. The south reef is apparently the one which has been followed in the bottom level and in which no payable values were met with until a point about 220ft. east of the shaft where it apparently joins again with the northern, and has granite on both walls, the footwall for the previous 220ft. being a crushed and

BULLETIN No 28

PLATE C



PLAN
OF
Gt WESTERN G.M.Ls
WILSON'S PATCH
Mt MARGARET G. F

much altered greenstone ; a short crosscut put in north, about half way along the drive would soon prove this.

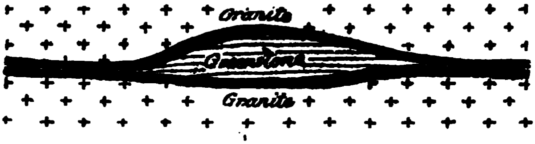


Fig. 4.—Plan showing the mode of occurrence of the Great Western Reef, Wilson's Patch.

The average size of the northern make of stone throughout the workings was from two to two and a half feet, and it consists of hard laminated iron-stained quartz, carrying a good deal of sulphide in the bottom levels ; the country is fairly soft in the upper workings, but is getting pretty hard along the lower level.

At the east end of the lease two parallel lines of reef about half a chain apart have been opened up, but not very much work has been done upon them ; the south reef appears to be the continuation of the main line, which has been faulted just east of the present workings. Owing, however, to the covering of recent deposits it is hard to follow the exact line of it on the surface.

Some work has also been done on the west end of the main line of reef, and some fairly good stone is said to have been taken out.

At the east end of the leases a little alluvial has been worked ; it was only a small patch, and has apparently been all worked out ; the gold was most likely shed from small leaders, and not from the main reef.

Table showing the Yield of the Great Western.

Year.	Ore Crushed.	Gold therefrom.	Rate per ton.
	Tons.	Ozs.	Ozs.
Prior to 1904	1,619·50	704·45	·43
1904	3,820·00	2,623·99	·69
1905	4,436·00	2,659·81	·59
1906	7,505·00	2,705·29	·36
Total	**17,380·50**	**8,693·54**	**·50**

Teutonic, G.M.L. 239 (Lorna's Luck, Ltd.).—This property was originally equipped with a five-head battery, but it was dismantled after only a few tons of stone had been crushed, and the mine has been abandoned for some years.

A good main shaft has been sunk to a depth of 200ft., but not much work has been done from it. The workings were full of water and inaccessible at the time of my visit, but the reef, which runs about east and west, and dips about north, is said to have been about four feet in thickness, and very regular. The quartz is white and glassy, and strongly laminated. The country is massive granite. Water level is about 70ft., and the supply is fresh.

Table showing the Yield of the Lorna's Luck, Ltd., G.M.Ls. 1116, 1117, 1121, 1122 {Teutonic, G.M.L. 1116 (239); Corona, G.M.L. 1117}.

Year.	Ore crushed.	Gold therefrom.	Rate per ton.
	tons	ozs.	ozs.
Prior to 1903	90·00	101·22	1·12
1903	20·00	14·12	·70
1904	15·00	13·70	·91
1905	82·00	60·81	·74
Total	207·00	189·85	·91

Corona, G.M.L. 1117 (642).—A fairly long line of reef runs through this lease on a bearing a few degrees north of west and south of east, having a steep dip to the north; it appears to be following along the junction of the granite with a small area of included greenstone, but it is hard to say exactly, as most of the surface detail is hidden by recent deposits.

Very little work has been done, and the property is now abandoned; the reef at the surface is about two feet in thickness, and of hard white laminated quartz. Small bunches of galena occur here and there in the reef, as well as a little zinc blende, and when this happens the gold contents are said to be generally high; the bulk of the stone is very low grade.

Chandler's Reward, G.M.L. 541.—This is said to have been the original Reward Claim of the district, and is situated about ten miles north-west of Wilson's Patch townsite. The country is all granite, and the workings are on a small quartz reef right at the foot of a large "breakaway." This reef runs about due east and west, and is almost vertical; the quartz is the typical granite variety, hard, white, and glassy, and a good deal laminated.

A good deal of work appears to have been done on it, but the lease has been abandoned for some years, and the workings were inaccessible. The gold is said to have occurred in small pockets, from which it was obtained by dollying; the bulk of the stone is of no value.

Table showing the Yield from the Wilson Patch Leases (other than those already mentioned) up to the end of 1906.

Name of Lease.	No. of Lease.	Ore crushed.	Gold therefrom.	Rate per ton.
		tons	ozs.	ozs.
Celtic	666	25·50	44·61	1·75
Dorothy	1128	20·00	8·44	·42
Irish Queen	402	14·00	* 136·30	9·73
Narcissus	258	19·10	28·22	1·47
Norseman	710	9·50	11·53	1·21
Sons of Lawlers	520	285·00	159·61	·56
Teutonic Extended	651	6·50	4·22	·65
Sundry claims	...	188·50	118·24	·62

* Includes 99·38ozs. dollied and specimens.

The Country between Wilson's Patch and the Linger and Die.

(25 miles south-south-east.)

Between these two places the country is nearly all flat and covered with loose sandy soil overlying granite. About five miles from the Linger and Die is a large "breakaway" extending south-easterly and easterly for many miles, and known as the Terraces: this "breakaway" marks the southern face of a large granite tableland, extending northwards for many miles; it runs easterly with a few breaks to a point nearly north of Mertondale, being a few miles to the north of the road all the way.

THE LINGER AND DIE.

This centre is situated near the most southerly corner of the big "breakaway" mentioned above, and about 18 miles due north of Leonora.

One or two prospecting shows were working at the time of my visit, but the place was practically dead.

The district was originally worked some ten or twelve years ago for alluvial, but only a few ounces were obtained, this being mostly got as small specimens in a gully running southerly down from the "breakaways."

The country is entirely granite, and running through it are numerous small quartz reefs; these have a general trend about north-west and south-east, and are mostly only a couple of inches in thickness; some of them are said to carry gold in payable quantity, and one or two have been worked with satisfactory results.

Water is obtained at a soak in the creek, and it is from this soak that the district takes its name. There is also said to be a well four or five miles to the south, in which there is a good supply of fresh water.

The Leonora-Malcolm belt of greenstones apparently reaches close to the Linger and Die, this being the southern limit of the granite area.

Two prospecting parties were working at the time of my visit, one on a small leader in the granite near the soak, and the other on a large quartz reef in a belt of greenstone schist, about a mile farther south.

Myrtle, G.M.L. 1173.—This lease is in the granite, and a small quartz leader is being worked on it ; this leader is from one to two inches in thickness, and runs about north-west and south-east. A good deal of work has been done on it, and about 20 tons of stone taken out ; the owners had about 5 tons bagged at the time of my visit, which they expected to yield 8ozs. or 10ozs. to the ton ; they expressed their intention of throwing up the lease, as the country was getting too hard.

Several other leaders had been worked, but they were apparently no good.

Champion Mine.—This lease is about a mile south of the soak, and was being worked by a small party who were taking out stone at a depth of about 25ft. from a large rubbly quartz reef. This reef is on the north-east edge of a belt of weathered greenstone (?) schist, at its junction with the granite ; it runs about north-west and south-east, and underlies to the north-east ; there is a big irregular outcrop (blow), but it is of no length, being hidden by a covering of recent deposits.

A shaft has been sunk to a depth of 150ft., and crosscut put in to the reef at this depth ; two feet of reef is said to be exposed in the face of this crosscut, and it is said to be not yet through it; the reef is here said to be worth about 10dwts. These workings were inaccessible.

The present workings are about 25ft. from the surface, where a parcel of about a hundred tons is being taken out for a trial crushing.

The full width of the ore body is not exposed, but nearly twenty feet has been opened up, and is said to be all payable ; this body consists of a mixture of schist and rubbly quartz, with occasional good-sized bodies of solid quartz ; it will probably turn into a solid, but much smaller body of quartz at a depth ; close to the surface it is naturally very broken and irregular.

If this trial parcel gives a return of only six or eight dwts. the property should be well worthy of further development. At present all stone has to be carted into Leonora, and this is said to cost 20s. per ton.

The Country between The Linger and Die and Morgans.

The road from the Linger and Die to Morgans (the old Cue-Mt. Margaret Road) passes a few miles north of Mertondale and the Waitekauri, and practically follows the southern edge of the large granite area extending from Wilson's Patch and Darlot easterly almost as far as Erlistoun. The road passes over low granite ridges and sandy plains—the greenstones lying a few miles farther south—until close to Mertondale, where it comes on to greenstone flats covered with recent deposits and heavily timbered with mulga ; after a few miles of this, there are more sandy flats and granite ridges, as it passes the eastern end of the Terraces near what is known as the Chain of Waterholes, these being a series of large holes in weathered granite, which hold a good supply of water for several months after rains. About half a mile south of these is a Government Well with a good supply of fresh water ; this well is in greenstone, the junction between the two classes of rock being about 20 chains or so north ; this greenstone is the northern end of the Leonora-Mertondale-Morgans belt. From the Chain of Waterholes the road continues over granite country, mostly sandy flats, passing a few miles north of the greenstone area all the way until some ten or twelve miles from Morgans, when the granite gives place to greenstones, these being continuous into Morgans. They are, however, mostly covered with varying thicknesses of recent deposits.

CHAS. G. GIBSON,
Assistant Geologist.

Perth, 13th April, 1907.

APPENDIX I.

List of Rock Specimens.

No. of Spec.	No. of Micro. Slide.	Description of Specimen.	Locality.
7100	735	Massive amphibolite ...	½ mile South of Malvolio, G.M.L. 189, Lawlers
7101	736	Massive granite ...	¼ mile North of Explosives Reserve, Lawlers
7102	...	Greenstone	1 mile N.N.W. of Lawlers
7103	...	Granite (dyke rock) ...	¾ mile N. of Bounty, G.M.L. 19, Lawlers
7104	...	Massive greenstone ...	Puzzler, G.M.L. 650, Lawlers
7105	737	Amphibolite (tremolite rock)	½ mile N.W. of British-American, G.M.L. 714, Lawlers
7106	738	Dolerite (dyke rock) ...	Near Explosives Reserve, Lawlers
7107	739	Greenstone	½ mile E. of Bounty, Lawlers
7108	740	Do.	Do. do.
7109	741	Do.	No. 4 level E.M.U., Lawlers
7110	742	Greenstone schist ...	Crosscut No. 2 level, E.M.U., Lawlers
7111	743	Granitic schist... ...	Footwall, intermediate level, E.M.U., Lawlers
7112	744	Massive granite ...	No. 4 level, E.M.U., Lawlers
7113	745	Porphyritic greenstone	Copperfield, G.M.L. 4525, Mt. Ida
7114	746	Do. do. ...	1 mile S. of Ida G.M., Mt. Ida
7115	747	Crushed greenstone ...	Ballance, G.M.L. 4549, Mt. Ida
7116	...	Zoisite (in greenstone)	1½ miles S. of Bellevue, G.M.L. 24, Sir Samuel
7117	...	Granite	¾ mile S. of Bellevue, G.M.L. 24, Sir Samuel
7118	748	Massive greenstone ...	Waikato, G.M.L. 363, Darlot
7119	...	Galena (in quartz) ...	Corona, G.M.L. 1117, Wilson's Patch

INDEX TO NAMES OF PLACES, MINES, REEFS, ETC.

Page

Acidic Dykes ... 13
Admiral Dewey Lease ... 30
A1 Leases ... 59
Alluvial Gold ... 15
Amazon Lease ... 58
Anglo-Continental Gold Syndicate, Ltd. ... 43, 44

Battery Reserve 8696 ... 43
Bald Hill Lease ... 51
Ballance Lease ... 68
Ballangarry Extended Lease ... 59
Ballangarry Lease ... 56, 57
Ballangarry Reef ... 57
Balmoral Lease ... 59
Barton Lease ... 44
Basic Dykes ... 13
Batteries ... 8, 30, 35, 45, 48, 53, 60
Bellevue Mine ... 8, 9, 46, 47, 48, 49, 68
Belvidere Lease ... 44
Birthday Lease ... 31
Blatchford, T. ... 8, 9
Blue Spec Lease ... 59
Boomerang Lease ... 59
Boudies Nest ... 44
Boudies Nest No. 1 North ... 44
Bounty Extended Lease ... 30
Bounty Lease ... 24, 68
Bower Leases ... 32
Brilliant Leases ... 30
British-American Alliance Lease ... 30
British-American Lease ... 11, 68
British King Cyanide Works ... 30
British King East Lease ... 59
British King Leases ... 26, 52, 59
British King North Lease ... 59

Calliope Lease ... 51
Caroline Baker Lease ... 30
Caroline Lease ... 14, 25, 26, 27
Celtic Lease ... 65
Chain of Waterholes ... 67
Champion Lease ... 66
Chandler's Reward ... 61, 64
Cinderella Battery ... 30
Cinderella Lease ... 30
Clifton, A. G. ... 8
Commonwealth Lease, Lawlers ... 30
Commonwealth Lease, Mt. Ida ... 44
Condor Cyanide Works ... 51
Condor Lease ... 51

Page
Condor United Lease ... 51
Connaught Lease ... 30
Copperfield Lease ... 33, 34, 36, 68
Copperfield Reef ... 34
Corona Lease ... 64, 68
Currajong Lease ... 44
Cyanide Works ... 30, 45, 51

Darlot ... 7, 8, 9, 51, 60, 67
Darlot Brown Hill Lease ... 59
Darlot State Battery ... 60
David Copperfield Lease ... 36
Davy Die Lease ... 44
Dobra Serica Lease ... 19
Donegal Lease ... 30
Donegal North Lease ... 30
Dorothy Lease ... 65
Dreyfus Lease ... 30
Duella Well ... 31
Dyke ... 13

Eastern Reef ... 25
Eastern United Extended Lease ... 30
East London Lease ... 59
East Murchison Goldfield ... 7, 8, 10
East Murchison United Mine ... 8, 12, 13, 14, 17, 23, 24, 25
Eildon Lease ... 59
Empire Leases ... 11, 23
E.M.U. Lease ... 68
Erlistoun ... 67
Esmeralda Lease ... 30
Evening Star Lease ... 44
Excelsior Lease ... 27, 28, 30
Excelsior North Lease ... 27, 29

Fairyland ... 27
Fairyland Lease ... 27, 29
Federation Lease ... 35, 36
Federation South Lease ... 44
Filbandint Lease ... 54, 55
Fingall Reefs Extended, Ltd. ... 59
Fitzgerald Mr. ... 17
Forest Belle ... 41, 42
Forest Belle North ... 43
Forsaken Lease ... 30

Glasgow Lass Lease ... 17, 18, 20
Golden Vale Lease ... 44
Goodenough Lease ... 51
Good Hope Lease ... 44
Granite ... 11, 12
Great Eastern Extended Lease ... 30
Great Eastern Mine ... 8, 12, 13, 14, 17, 24
Great Mt. Ida Lease ... 44
Great Western Lease ... 51, 61, 62, 63
Great Western Reef ... 63
Greenstone ... 10, 11, 38, 46
Gunbearer Lease ... 44

Page
Harpur's Hill Lease ... 30
Harris' ... 11, 14, 15
Hidden Secret Lease ... 18, 19
Homeward Bound G.M. Co. ... 59

Ida Gem Lease ... 44
Ida Lease ... 43, 44, 68
International Lease ... 30
Irish Queen Lease ... 65
Isidore Lease ... 51

Jones Creek ... 9

Kaira Lease ... 30
Kannuntoo Lease ... 30
Kinambla Wealth of Nations Lease ... 30
King Edward Lease ... 20, 21
Kinglake Lease ... 27, 29
King of the East Lease ... 60
King of the Hills Leases ... 60
Kurrajong Lease ... 44
Kyneton Lease ... 60

Lady Doris Lease ... 44
Lady Doris West Lease ... 44
Lake Darlot ... 52, 53, 59
Lake Miranda ... 9, 45, 46
Lake Way ... 8, 9
Lass o'Gowrie Lease ... 60
Lawlers ... 7, 8, 9, 10, 11, 14, 15, 17, 30, 31, 45, 51, 68
Lawlers Reef ... 25
Lawlers Public Battery ... 30
Leinster Leases ... 30
Leinster North Lease ... 30
Leonora ... 10
Leonora Belt ... 61
Leviathan District ... 27
Leviathan Lease ... 27
Lillian Lease ... 30
Linger and Die ... 7, 65, 66, 67
Lode ... 14, 34, 47
London and West Australian Exploration Co., Ltd. ... 24, 25, 26, 59
Lone Hand Lease ... 30
Lone Star Lease ... 22, 23
Lorna's Luck, Ltd. ... 63, 64

Main Lode Lease ... 39, 40
Malvolio Lease ... 68
Mark Twain Lease ... 30
Maroon Hills ... 31
May Be ... 23, 24
McCaffrey's ... 15
McDonough's Lookout ... 9
Melbourne Lease ... 30
Mertondale ... 65, 67
Mesozoic Age ... 8
Mikado Lease ... 30
Monte Christo Lease ... 52, 53, 54

Page
Morning Light Leases ... 60
Morgans ... 7, 67
Mt. Clifford ... 62
Mt. Clifford Belt ... 61
Mt. Goode ... 9, 46
Mt. Ida ... 7, 31, 32, 41, 68
Mt. Ida Consols, Ltd. ... 32, 36, 37
Mt. Ida Cyanide Works ... 45
Mt. Ida Lease ... 33, 44, 45
Mt. Ida Meteor Lease ... 40, 41
Mt. Ida Mystery Lease ... 45
Mt. Ida Reward ... 41
Mt. Ida State Battery ... 45
Mt. Margaret Goldfield ... 7
Mt. McAuley Lease ... 30
Mt. Pickering ... 51
Mt. Waite ... 7
Myrtle Lease ... 66
Mystery Lease, Darlot ... 60
Mystery Lease, Mt. Ida ... 45

Narcissus Lease ... 65
Nelly Bly Lease ... 45
Never Can Tell Lease ... 23, 24
New Chum Lease ... 45
New Holland Lease ... 19, 20
New Woman Leases ... 30
New Woman South Extended Lease ... 30
Norseman Lease ... 65
North Coolgardie Goldfield ... 7, 31

Ogilvie's ... 15
Once More Lease ... 45
Ore Deposits ... 14, 34, 47

Pactolus Lease ... 39
Pactolus South Lease ... 45
Peperill Hill ... 7
Pick Me Up Lease ... 30
Pinnacles, The ... 31
Pioneer Lease ... 45
Plum Lease ... 30
Pocahontas Lease ... 45
Pride of Darlot Leases ... 60
Puzzler Lease ... 30, 68

Quartzite King Lease ... 30
Quartz Reefs ... 14, 34, 47
Queen Lease ... 14, 39

Rajah Leases ... 30
Recent Superficial Deposits ... 14, 46
Reed, F. ... 8
Right Bower Extended Lease ... 22, 23
Right Bower Lease ... 22
Right Bower North Lease ... 22, 23
Rio Tinto Lease ... 41
Rise and Shine Leases ... 60
Rose Lease ... 60
Royal Welshman Lease ... 60

Page
Sandstone Lease ... 45
Shamrock Lease ... 60
Simpson, E. S. ... 47
Sir Samuel ... 7, 8, 9, 11, 45, 68
Sisters, The ... 31
Smith's Battery ... 29
Sons of Lawlers Lease ... 65
Star of the East Lease ... 45
St. George's Lease ... 55, 56
Stornaway Lease ... 45
Sultan Lease ... 19
Sunrise Lease ... 21, 22
Surprise Lease ... 30
Sylvia Lease ... 60

Table of Analysis ... 47
Teutonic Lease ... 63, 64
Teutonic Extended Lease ... 65
Timoni Lease ... 36
Timoni Reef ... 34
Tit Lark Lease ... 45
Try Again Lease ... 45

Unexpected Lease ... 37, 38, 39
Unexpected North Lease ... 37, 38, 39
Unexpected Reef ... 38
Unexpected South Lease ... 39
Urquhart and Hayes' Cyanide Works ... 30

Vanguard Lease ... 47, 49, 50
Victor Lease ... 30
Violet Range ... 9, 45, 46
Vivien Gem Lease ... 30
Vivien Lease ... 11, 14, 15, 16
Vivien View Lease ... 30

Waikato Lease ... 60, 68
Wait a Bit Lease ... 30
Waitekauri ... 67
Waroonga Mine ... 14, 15, 16, 65, 67, 68
Waroonga North Lease ... 30
Waroonga South Extended Lease ... 30
Waroonga South Leases ... 26
Wee Jim Lease ... 60
Wild Rose Lease ... 45
Wilson's Patch ... 7, 8, 61, 65, 67, 68
Wiluna ... 9
Woodward, H. P. ... 31

Yongala Lease ... 30

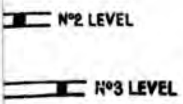
Zangbar Lease ... 52, 54, 55
Zoisite ... 47

By Authority: Fred. Wm. Simpson, Government Printer, Perth.

LIBRARY
OF THE
UNIVERSITY
OF
CALIFORNIA

BULLETIN No28 PLATE II.

. M.



A Gibb Maitland
Government Geologist

R.H. Irwin del:

H.J Pether. Government Lithographer. Perth. W.A.

LIBRARY
OF THE
UNIVERSITY
OF
CALIFORNIA

LIBRARY
OF THE
UNIVERSITY
OF
CALIFORNIA

LIBRARY
OF THE
UNIVERSITY
OF
CALIFORNIA

[illegible]

Have [illegible]
No. 1-32

1907.

WESTERN AUSTRALIA.

GEOLOGICAL SURVEY.

BULLETIN No. 29.

A Report upon the Geology, together with a Description of the Productive Mines,

OF THE

CUE AND DAY DAWN DISTRICTS,

MURCHISON GOLDFIELD.

PART I.

CUE AND CUDDINGWARRA CENTRES.

BY

HARRY P. WOODWARD,
Assistant Government Geologist.

Issued under the authority of the Hon. H. Gregory, M.L.A.
Minister for Mines.

WITH THREE MAPS AND FIFTEEN PLATES OF SECTIONS.

LIBRARY
OF THE
UNIVERSITY
OF
CALIFORNIA

PERTH:
BY AUTHORITY: FRED. WM. SIMPSON, GOVERNMENT PRINTER.
1907.

LIST OF PHOTOGRAPHS.

Pag
1. A specimen of Grano-diorite, showing segregations ... ...
2. The Table Top Hill from the "Patch" 1
3. The Flat Topped Hill from a distance 1
4. The Flat Topped Hill 1
5. The Point of Flat Topped Hill 1
6. The Hanging Rock 1
7. The Elephant Rock 2
8. The Pinnacles 2
9. The Reef in the Volunteer South Extended ... ...
10. Do. do. do. ... ...
11. A specimen of Worm-bored Rock ... ...
12. Pinnacle Hill near Cuddingwarra ... ...

LIST OF BLOCKS.

Fig. I.—Diagram of the Salisbury Mine ... ...
Fig. II.—Diagram of the Cue No. 1 Mine ... ...

A Report upon the Geology together with a description of the Productive Mines of the Cue and Day Dawn Districts.

PREFATORY NOTE.

The work of constructing a geological map of the Cue and Day Dawn districts was commenced as far back as 1902, when Mr. W. D. Campbell, Assistant Geologist, spent some months in the district, on account, however, of his services being required in another locality the work was suspended, but a preliminary map of the auriferous reefs of Cue and Day Dawn was issued in 1903 with notes upon the mines, as Bulletin No. 7.

This work was, however, resumed in May, 1906, by myself, with the assistance of Mr. H. W. B. Talbot, Field Assistant, who made a very complete and accurate topographical survey of the district, contour lines being run at intervals of 10 feet in altitude, and the area covered being 66 square miles.

Upon the map thus prepared the geological features, with the positions of the shafts and dry-blowing patches, have been laid down, whilst the plans of the underground workings as far as obtainable have been reduced and reproduced in plate form.

For the convenience of reference the geological map has been divided into three sections, but these can be joined together if so desired, as they slightly overlap.

Owing to the rather voluminous character of the report it has been issued in two parts, the first of which is confined to the Cue and Cuddingwarra centres, and the second to the Day Dawn, a considerable portion of the latter being occupied by a fairly elaborate report upon the Great Fingall Mine, which not only deals with it from a geological standpoint, but also from that of a mining engineer.

The whole concludes with an appendix by Mr. E. S. Simpson, B.E., F.C.S., etc., Mineralogist and Assayer to the Department u on the petrology of the district.

A very complete index to the names, places, reefs, etc., occurr g in this report has been prepared by Mr. P. J. Atkins, clerk to tl Department.

HARRY P. WOODWARD,
Assistant Government Geologist.

ological Survey Office,
Perth, May 1st, 1907.

PART I.—CUE AND CUDDINGWARRA CENTRES.

SECTION I.—THE CUE MINING DISTRICT.

(With Geological Map).

GENERAL.

The township of Cue, which is the official centre of the Murchison Goldfields, is situated upon the Northern Railway, 262 miles from Geraldton, the port, the latter being connected with Perth by the Midland Railway, the distance being 306 miles ; it is 1,485ft. above the sea level, and lies upon the western edge of a broken granite plateau, which extends for a considerable distance to the eastward. There is a slight but general fall from Cue to the north, south, and west, but the whole of the drainage eventually finds its way towards Austin's Lake, which lies to the southward.

Generally speaking the surface is fairly flat, the only hill of any size being the Cue Trig., which rises immediately to the eastward of the town and attains an elevation of 1,630ft. above sea level ; the remainder consists of small flat-topped hills, the ruins of the granite plateau which formerly spread over the greater part of this area.

The water supply of the town is obtained from Jack's well, situated about 10 miles to the northward, being pumped to the supply tanks upon the Cue hill, from whence both this town and also Day Dawn are reticulated.

Fresh water is met with in sinking at a depth of about 100ft. all over the district, but with the exception of the Mafeking, the supply from the mines is not great, in fact barely enough for their own requirements.

The average rainfall is about 8½ inches, but with the exception of a few small tanks used in catching the water from the houses for domestic purposes, no scheme of water conservation exists.

From the following table showing the rainfall for the last 10 years with the number of days upon which it fell, it will be noticed that the fall is extremely variable :—

	Yearly Total.	No. of Days.	Year.	Yearly Total.	No. of Days.
1897 ...	6·58	32	1902 ...	9·00	32
1898 ...	5·34	29	1903 ...	5·96	42
1899 ...	3·46	30	1904 ...	12·29	42
1900 ...	19·75	52	1905 ...	8·14	44
1901 ...	4·81	27	1906 ...	10·50	39

HISTORICAL.

Cue may be regarded as one of the old mining districts of t State, starting its existence in the year 1891, when Tom Cue c covered gold upon what is now known as the "Patch," which v very productive during that and more particularly the follow year.

During the course of 1892, the main patch was practica worked over, but a new discovery was made of what is known the "Pearling Ground," which lies more to the eastward and dif from the "Patch" in the fact that nearly all the gold was fo in the form of "specimens" (*i.e.*, gold attached to quartz) u the surface of the shallow clay which overlaid the rock.

This ground was worked in a systematic manner by the digg who, finding that much time was wasted by wandering round over same ground time after time, organised themselves into a co who might be seen day after day pacing across the area like a of troops in skirmishing order, each armed with a forked stick w which to turn over the stones.

Although many reefs outcropped upon these areas they w mostly of little value and bore no relation to the rich strewn qua the origin of which will be dealt with later on.

In this same year attention was first attracted to the re Pead and Edwards pegging out what is now the Cue 1, and P dergast the Rising Sun ; two other reefs in the same locality ca at the time the Harp of Erin and the Phœnix were in all probab upon what was later on known as the Lady Mary line. In centre of the town, upon what was later known as the Catalp claim was also pegged, which was called the Lady Kintore; wh O'Neil and Jackson also had a reef about 1½ miles to the no east of Cue, which is in all probability the Golden Stream.

With the year 1893, this field may be said to have chan from an alluvial diggers' camp into a mining centre. Numbers reefs were opened up, and several passed into the hands of c panies which for the most part in the first instance were So Australian.

During the next year a considerable boom took place in district, when the agents from the British and Continental spec tor scoured the country ready to purchase or take options u anything showing gold ; these properties were at once placed u the London market and floated with large nominal and small w ing capitals, machinery was ordered and shipped, and mana appointed.

The sudden demand for machinery put up its price, and a c siderable quantity of very inferior stuff was purchased, wh landed on the ground with heavy cartage added, represented a v considerable figure.

PHOTO. 1.

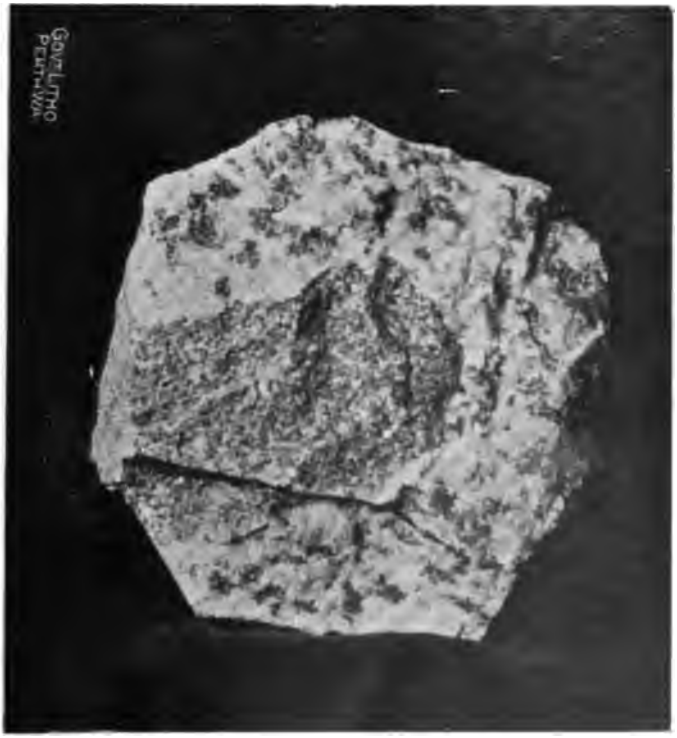


Photo., R. H. Irwin.

A specimen of Granodiorite showing segregations.

When the erection of these plants was undertaken, vital parts were generally missing, which were sometimes found later on under the sand upon the Geraldton beach, or it was discovered that they had been carted to other mines, sometimes at considerable distances.

In many instances after the plant and buildings were satisfactorily erected, it was discovered that no development had taken place, and there was neither stone nor water available for crushing, which being the case, the long expected return not coming in, the investors removed their money to Coolgardie, and a little later, to Kalgoorlie, which mining centre had just started at this time to create a sensation ; the consequence being that most of the mines around Cue were closed down and the plant sold for what it would fetch.

A few of the companies lingered on for a few years, but they eventually, with the exception of one or two, also wound up when the properties passed into the hands of local companies or private individuals. In spite of everything, however, this district has, since the earliest reliable records appear, been a steady producer of from 15,000 to 20,000 ounces of fine gold per annum.

Of many of the old mines there exists absolutely no record, and as no attempt has been made to unwater them since their abandonment many years ago, valuable bodies of stone may exist in them. Also in other cases large low-grade ore bodies may be found to enclose the small rich veins originally worked, the latter only being payable at the time owing to the crude treatment without cyanide extraction.

A very considerable profit has been made by treating the sands from these old mines, but as the result has not been added to the original crushing returns these are incomplete, whilst no record at all of crushing prior to 1896 appears to exist, except in the case of one or two of the principal mines.

The question of testing these old abandoned mines is too costly a matter for the ordinary prospector, and would have to be either undertaken by a company or a person with capital, for not only would machinery be required, but a considerable outlay upon securing and unwatering the old workings before an inspection could be made, for in most cases all accessible timber has been removed from the shaft collars, etc.

The Government have spent a considerable sum in this district upon subsidising prospecting the lodes at a depth, but so far for various reasons the work has not been successful. There is no State Battery at Cue, but no trouble has been experienced in getting crushing done upon satisfactory terms, owing to the fact that no less than three privately owned batteries undertake crushing for the public.

Appended will be found a return giving the quantity of stone crushed each year and the gold yielded in fine ounces since 1897, whilst prior to that date it is given approximately. This table shov that a total of 233,602 tons of stone crushed yielded 212.855 ounc of fine gold, or at the rate of .91 ounces per ton.

** Table showing the Annual Production of the Cue District.*

Year.	Ore Crushed.	Gold therefrom.	Rate Per T
	tons.	ozs.	ozs
Prior to 1897	16,882·00	20,827·00	1·
1897	26,270·50	20,527·54	·
1898	32,482·35	22,037·29	·
1899	17,058·27	21,869·47	1·
1900	17,461·00	18,383·98	1·
1901	17,493·55	18,755·54	1·
1902	21,528·93	21,016·82	·
1903	22,480·50	20,688·78	·
1904	18,912·50	15,286·71	·
1905	19,074·89	15,125·05	·
1906	23,077·00	18,337·11	·
Total	**233,602·49**	**212,855·29**	·

One very serious question in this district is and has been f a considerable time the timber and fuel supply. With the object c alleviating this, it has been proposed to construct a light railwa line, but this if run for wood alone in this sparsely timbered cou try could not possibly pay interest, leaving the sinking fund out c the question. If on the other hand it were constructed so as to ser outlying mining centres, the inhabitants of these would natural object to the country surrounding them being depleted of timber ar firewood in order to supply other districts.

The recent discovery of coal upon the Greenough River giv promise of an early settlement of this fuel question, whilst t timber one could be more economically solved by a concession c the freight rather than the construction of a valueless railway lin

DESCRIPTIVE GEOLOGY.

The geology of the Cue district although presenting mar features which are in common with those of the other mining centre varies considerably not only in the nature of its rocks, but in t mode of occurrence of its ore deposits.

The general conditions under which gold deposits occur in t crystalline series in this State are in more or less lenticular shape amphibolite belts, the longest axis of which has a north-wester direction, it being surrounded or sandwiched with gneissic granit the whole being intersected by numerous felspathic dykes.

---

* This Table includes—Cue, 201,952·85 tons for 169,433·53 ounces; Cuddingwarra 26,644·25 tons for 35,461·78 ounces, and district generally 4,649·64 tons for 7,959·98 ounces.

PHOTO. 2.

Geological Survey

Bulletin No. 29, Part I.

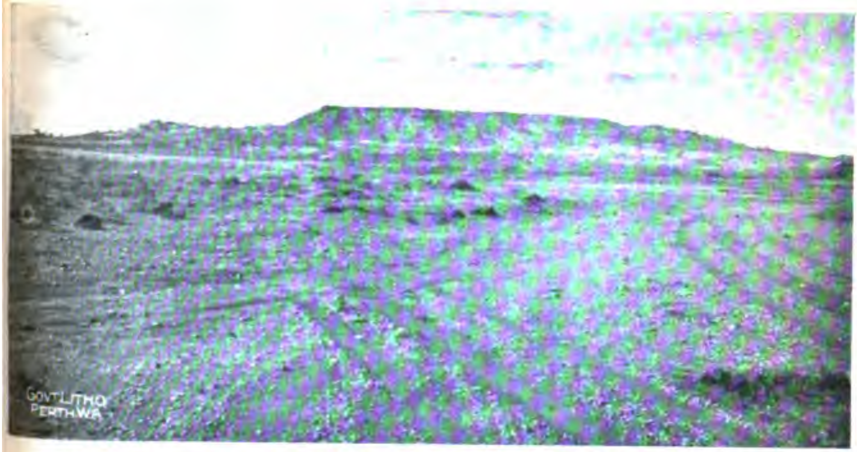


Photo., H. P. Woodward.

Table Top Hill from "The Patch."

PHOTO. 3

Geological Survey.

Bulletin No. 29, Part I

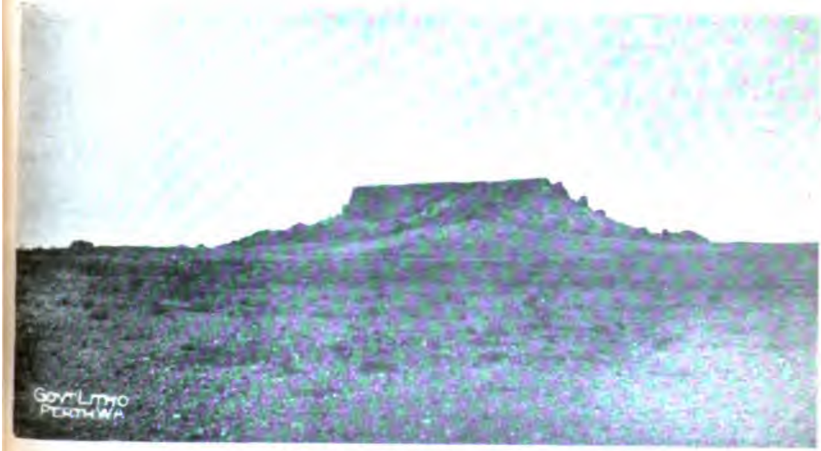


Photo., H. P. Woodward.

The Flat-topped Hill from a distance.

The quartz reefs, except upon very rare occasions, are confined exclusively to the basic rock areas, and although they are never auriferous without acidic rocks are present in the vicinity, the lines of greatest enrichment may be so far distant that it is difficult to recognise any relationship, whilst when they do occur near the granite they generally assume a course more or less parallel to the junction of the two formations and may therefore be classed as parallel contact fissures.

In the district which is at present under review the amphibolites are only developed to the south-eastward corner, and are more coarsely crystalline in structure than is usual in the auriferous belts whilst the quartz reefs in them are of an extremely rare occurrence, but those which have proved to be of value adopt the usual course lying more or less parallel to the contact, but dipping towards it. When however we come to the acidic series, a great change is apparent, for here instead of the gnessic granites we have a magmatic intrusion of grano-diorite, a rock intermediate between the hornblende granites and the quartz diorites containing numerous rich reefs which not only lie parallel to the contact but more commonly radiate from it.

The following extract is taken from Mr. S. Goczel's report of 1895, who was at that time Field Geologist to the Government, and had visited this district in 1894:—

> Northwards from the Lake Austin depression and rising as we proceed in that direction extends the Cue-Day Dawn basin, in which the two central townships of the Murchison Goldfield and also the principal mines belonging to those two places are situated, numerous quartz reefs and also dykes striking in various directions, but most of them having a westerly underlay accompany a large break through the country.
>
> This break has a north-easterly course and passes immediately to the west of the Cue township. It follows more or less a junction between gneissic granite from the west and altered schists from the east.
>
> For considerable distances on both sides of the junction and chiefly along lodes and faults, the country formation has suffered alteration. In the Archaean granite the felspar becomes kaolinised and the mica (biotite) by removal of bases and hydration, changed into foliated talc. The schistose palaeozoic greenstones (chiefly felspar-amphibolites) were altered into a kind of chloritic schist.
>
> Immediately to the east of the Cue Township, a greenstone range rises to a height of a hundred or more feet above the level of the streets and at a short distance to the north several flat-topped isolated elevations, with steep declines, attain a height of from 30 to 60 feet above the general surroundings. Those isolated elevations or " table tops " as they are locally called, are remnants of an upper archaean stratum, the bulk of which was removed by lacustral denudation. At one time they were islands in an extensive inland lake, the old strands of which are often met with in the surrounding country.
>
> The " table-top hills " consist of rotten gneissic granite. They owe their resistiveness (which has preserved them during the attacks

of the lacustrine waves) chiefly to quartz lode formations, which wit their branches and veins extend along and partly also through th hills.

Depressions in the rotted gneissic granite on the tops of th hills contain remnants of conglomerate and sandstone beds whicl although no palaeontological proof exists, most likely are of Cambria age.

The reefs which are situated to the west of the main break hav as country formation, more or less decomposed gneissic granite ; an those situated to the east, altered schists.

Some of the lode fissures outside the first named formations a very wide, and contain besides bands of auriferous quartz, large gangu formations, consisting chiefly of talcose kaolin. this latter bein apparently derived from rotted granite country rock and was carrie into the fissures in mechanical suspension by percolating wate On the contrary the seams and veins of auriferous quartz were chem ically deposited and this class of lode can be ranked under the com pound lodes.

The intersection of reefs with cross reefs and cross fissures pla here also an important role in the occurrence of gold shoots. Tl shoots in lodes which have archaean rocks as country formation, ha usually a larger horizontal extent within the lode than shoots in lod within palaeozoic greenstones, although phenomenal richness goes mo with the latter class.*

At the time of Mr. Goczel's visit sufficient work had not bee done in mines within the granite area to reveal their true characte he therefore naturally classed the kaolinised surface rock with th gneissic granites of the other fields.

In the year 1895, this State was visited by Herr Ka Schmeisser, who in 1898 in his work on the Goldfields of Australas makes the following reference to the Cue and Day Dawn districts :-

†*Gold Reefs in West Australian Goldfields.*—The gold deposits West Australia which occur in the crystalline schists are of peculi interest both geologically and economically.

The country rock of a large number of gold veins consists of a ro which is locally called diorite by the miners. This designation ought correspond to granular plagioclase hornblende rocks. Although su true diorites do occur in the Murchison districts as the country rock the veins, the greater majority of so-called diorites have a more or le schistose structure, and consist essentially of hornblende, as has be proved by the examination of a large number of samples collected b us on the spot. These rocks may, therefore, best be designated amphibolites.

The rock specimens examined were taken from the following loca ties in the Murchison goldfield:—

Trenton Mine, near Day Dawn.
Vein within the quartz-bearing diorite of the Lady Mary Min
100 feet level, near Cue.
Emperor Mine, near Day Dawn.
Cuddingwarra, near Cue.
Day Dawn Mine, near Day Dawn.

---

*Report of the Department of Mines for the year 1894. Appendix 4, report on the interior gold region of W.A.

†"Goldfields of Australasia" by Karl Schmeisser and Dr. Karl Vogelsang, translated by Henry Louis, M.A., published by McMillan and Co., London, 1898.

These rocks, when fresh, have mostly a dark green colour. Macroscopically they appear to consist essentially of a mixture of hornblende crystals which sometimes reach the size of 2mm. In most rocks the mixture is a very intimate one. Wherever a felspathic constituent plays any important part in the composition, it can be readily distinguished macroscopically in slightly decomposed rock by the presence of small whitish spots; many of the rocks show more or less distinct schistose structure.

Mining operations have shown that the amphibolites are decomposed to a very great extent, from the surface down to a depth of from 70 to 150 feet. There are a comparatively few places where they outcrop in an undecomposed condition; and are quarried for building material. When decomposed, they are converted into ferruginous gray, yellow, light or dark brown, soft and friable masses.

Under the microscope the essential constituent is seen to be green, strongly pleochroic hornblende; epidote, chlorite, quartz, and carbonates also occur, and, in a subordinate degree, biotite, apatite, titanite, zirkon, magnetite, ilmenite, and leucoxene. Hornblende always occurs in irregular fragments. In sections it is usually observed cut parallel to its longitudinal axis, frequently aggregated in approximately parallel bundles. Individual crystals are often shattered at their ends; cross-sections are rare, and a very decided parallelism is often noticeable in the direction of their length; frequently the quite irregularly formed sections have a rugged appearance. Foreign inclusions seem to be rare, though occasionally a few scattered grains of ore are seen. Epidote occurs at times in large isolated crystals, but generally in granular aggregates. Dirty green chloritic matter is abundant.

Generally there will be found between the hornblende a colourless, apparently xenomorphous mass, which from its behaviour between crossed Nicols seems to consist of a mosaic of quartz and felspars. The quartz is often rich in fluid inclusions. Twinning is rare in the felspars, and when it occurs is generally limited to the existence of two individuals with one single twinning plane, such as is generally characteristic of albite. Repeated twinning is exceedingly scarce. The mosaic of quartz and felspar is always traversed by large numbers of microlites of hornblende.

In the amphibolite from the Emperor Mine, quartz and felspar are found intermixed in such a manner as to form a very pretty graphic granite. Here and there larger portions of felspar are saussurised, and are replaced in the section by spots which appear of a dull white colour in diagonal light. Under the microscope these are seen to consist of an aggregate of irregularly disposed prisms and grains of zoisite, which, when of larger dimensions, show very distinct cleavage, straight extinction, and in other directions their steel-blue colour of polarisation. In the saussuritic parts the almost colourless zoisite is at times accompanied by slightly larger grains of greenish-yellow epidote. In these aggregates the partially preserved polysynthetic twinning of the former felspathic substance is often seen forming a kind of background. The existence of garnet, scapolite, or of any zeolitic mineral in this saussurite could not be proved. Zoisite occurs in the form of independent crystals in the rock mass, as well as in the saussuritic portions.

Highly refractive grains of titanite, which sometimes show a speck of ore as a kernel, are often arranged in rows or streaks. The scales of ilmenite are frequently coated with a skin of leucoxene. Many specimens are relatively rich in carbonates, which occur partly as thin dendritic films between the particles, and partly as larger grains with rhombohedral cleavage.

As the amphibolites form huge masses imbedded within the crystalline schists, and, moreover, frequently show a thoroughly well-marked slaty structure, it seems right to look upon them as genetically equivalent to the latter. This conclusion is apparently contradicted by the occurrence of amphibolites in a dyke about three feet thick which traverses the quartz diorite at the 196 feet level of the Lady Mary Mine at Cue, so that the eruptive origin of the former rock appears to be clearly shown here. Although there are no indications that this dyke was of a diabasic nature at an earlier period, and the amphibolite does not contain the remains of any pyroxenic constituent, still apparently the only possible explanation is that this dyke was originally diabase, and has been converted into amphibolite by the pressure of the surrounding strata ; this explanation has been accepted in numerous similar cases. The fact of this occurrence of amphibolite as a dyke does not render it impossible that the other huge masses of amphibolite are diabase rocks metamorphosed and rendered slaty by pressure. Possibly when their geological relations have been more completely investigated, other evidence bearing on this point may be forthcoming.

In the Murchison goldfield, quartz-diorite of almost granitic appearance occurs over an extensive area to the north of Cue, and to within about three miles to the south of this town, between the crystalline schists which lie to the east and west of the former rock. This rock is much decomposed to depths of 90 to 100 feet and converted into a friable kaolin-like mass, generally white, but often of a brownish colour. At a depth of 90 feet it has been met with in the Light of Asia gold mine in a tolerably good state of preservation.

A sample of the undecomposed rock from the 196 feet level of the Lady Mary claims was examined.

This quartz-diorite is tolerably coarse-grained, so that its constituents can be recognised by the naked eye. It approaches to tonalite in its almost equal proportions of biotite and hornblende. The rock must be considered as retaining in its present condition its principal primary characteristics, and cannot be regarded as an alteration product of diabase. Although at times the plagioclase felspars appear under the microscope to be rich in fine, very pale, green particles of hornblende, these cannot be considered as having been introduced secondarily, because they are often limited to the kernel of the felspar, which then shows an exterior zone perfectly clear and tolerably fresh. That the latter is no secondary growth is shown by the well-marked continuous direction of extinction of many of the crystals.

The quartz-diorite is traversed by numerous reefs striking and dipping in all directions; the thickness of these varies within considerable limits. Thus in Princess Ada it is in places seven feet, in the Red, White and Blue Mine eight feet, and in Light of Asia nine feet; it does not as a rule, however, average more than three to four feet.

The main constituent of the reef matter is a hard white quartz of irregular lenticular structure; between the quartz and the generally well-marked walls of the country rock a layer of kaolin occurs, containing numerous grains of quartz, and therefore sharp and granular to the touch; its colour is white, or at times light yellowish or brownish. This kaolin is obviously a product of the decomposition of the country rock.

The gold occurs principally in the body of the quartz, more rarely in the accompanying kaolin, generally finely disseminated, but often in specks visible to the eye, or in larger particles. In Cue 1 mine up to the time of my visit 1,089 tons of ore had yielded 1,750 ounces of gold, or an average of 1oz. 12dwt. 7grs. to the ton. In the Light of Asia the ore was said to have averaged 19dwt., in Princess Ada 24dwt., and in the Arcadia 2oz. 16dwt. to the ton. My samples from the Arcadia, however, gave me only 19dwt. 14grs. to the ton. As the reef outcrop almost invariably shows a certain enrichment in the gold contents, it is very doubtful whether these values will continue in depth.

PHOTO. 4.

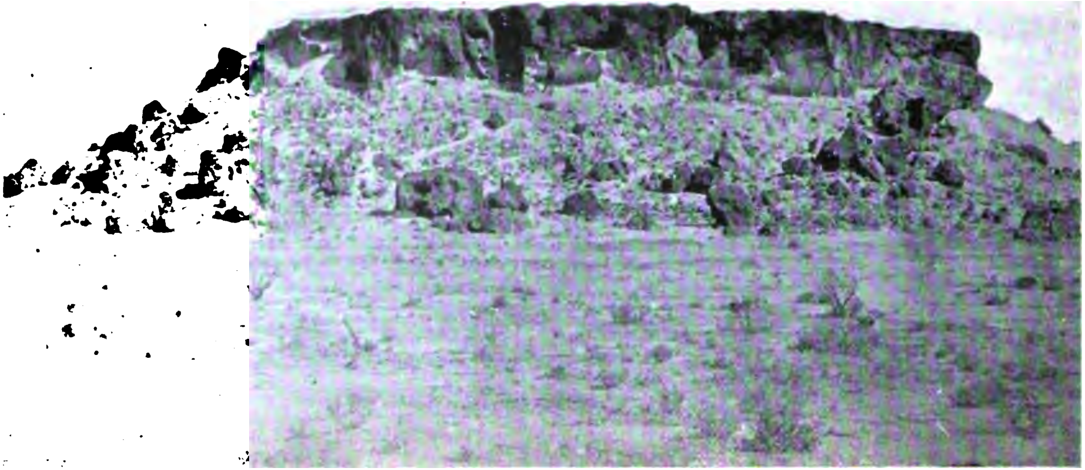


Photo., H. P. Woodward.

The Flat-topped Hill.

In the Murchison Goldfield the behaviour of the reefs in their longitudinal extension and in depth is very irregular. Some show an amount of regularity which justifies good expectations in both depth and extension; others wedge out rapidly in both directions, or pinch to such a degree as to arouse serious misgivings. Dykes of amphibolite, which may be looked upon as an altered diabase, frequently occur.

A portion of the Red, White, and Blue reef appears to be a contact vein between quartz-diorite on the footwall and amphibolite on the hanging-wall.

Well-marked slickensides are frequently found in the vein-matter.

The zone of decomposition of the reef matter extends to very different depths in the different mining districts. In Cue, for example, it extends to a depth of from 60 to 70 feet, in the Menzies and Kalgoorlie districts to an average of from 130 to 180 feet, but even within the same mining district the depth will be found to vary.

The country rock is generally decomposed to quite the same depth as the veins themselves.

The reefs are occasionally traversed by cross-veins carrying gold. by diabase and other dykes, and by fissures generally combined with faults, normal or reversed, though these occurrences are not very frequent.

With regard to the origin of the veins, I expressed myself as follows in my short report, dated January, 1896:—

"The simple veins, as also the composite veins, are as a rule to be looked upon as mineralised fissures. Their formation was due generally to faulting of the strata, usually normal, more rarely reversed. In the case of composite veins, when these movements took place, they produced great pressure on considerable portions of the country rock, which was shattered. The pulverised rock lying between the hanging- and the foot-wall became partly metamorphosed by mineral solutions, and formed the vein matter. Slickensides are very frequent and must have been produced by pressure. The simple quartz reef and the composite vein are, however, only extreme types of vein formation. for veins are to be found in all stages of development between them. The transition forms, which are as a rule much poorer than the typical composite veins, are also frequently, although erroneously, called lode formations by the Australian miners, with the object of giving the deposit an appearance of greater value."

The following is a more or less detailed description of the rocks, dykes, and quartz reefs of the district ending with the conclusions deduced from a careful personal study of them in the field during the year 1906.

The formations exposed upon this field differ from those of the Eastern goldfields in that they cannot be divided simply into two main groups of crystalline and superficial, inasmuch as an intermediate series of ancient volcanic rocks and some scattered patches of elastic rocks, consisting of quartzite and breccia, are met with here capping several low hills.

Amphibolites.—Undoubtedly the oldest rocks of this district are the greenstones, which are only met with in the south-eastern portion of this district; they consist of dark green hornblende and felspar, often schistose, and have been classed under the heading of amphibolites in order to distinguish them from those of a more massive and decidedly intrusive character.

These rocks pass imperceptibly from red greasy clays into chloritic, serpentine and hornblende schists, then into a massive crystalline rock of possibly diabasic origin.

This gradual change in both the character of the rock and its mineral contents is due to hydration and shearing, but whether they are of igneous origin or not has not yet been conclusively proved. although it is highly probable. The main mass of the Cue Hill is composed of rocks of this class as well as the range which runs from it in a north-easterly direction, but they are of little economic value upon this field since in them very few auriferous reefs have been discovered, and the few that have lie for the most part in or near the contact zone.

Grano-diorites.—The grano-diorite, as its name implies, is neither a true granite or diorite but is a quartz diorite with a granitic structure weathering after the type of true granite to a gritty white kaolin. In composition it varies considerably as also do the proportions in which the various minerals exist, it being sometimes almost destitute of quartz, whilst at others mica (biotite) is almost absent, and again augite may predominate over the hornblende, or that mineral may be entirely absent.

In the massive rock, segregations often occur (Photo No. 1) which owing to their fine crystalline structure and darker colour greatly resemble diorite, but upon examination in thin section under the microscope they prove to have the same composition as the coarse crystalline portions of the rock except that they contain a larger proportion of hornblende.

This rock covers by far the larger proportion of the area embraced by the geological map, occupying all the central and north-western sections.

It appears to be a magmatic intrusion into the amphibolites, occurring as a belt which runs in a north-easterly direction about four miles in width ; the western boundary of the formation is not included in the Cue sheet but will be seen in the Cuddingwarra which joins it.

Very considerable interest attaches to this formation since it contains by far the larger number of the productive lodes, and upon its surface the alluvial patches were discovered.

One of the marked features of Cue is its isolated marquee shaped hills called "table tops," which hills rise abruptly to a height of about 60 feet above the surrounding country, but present a much more striking appearance when seen at a distance than when viewed close to their bases, thus a much better conception of them can be obtained from the photographs (Nos. 2 and 3) than from those of the individual hills taken closer.

In section these hills consist of layers of soft white kaolinised granite at the base, with hard reddish cappings of the same rock,

PHOTO. 5.

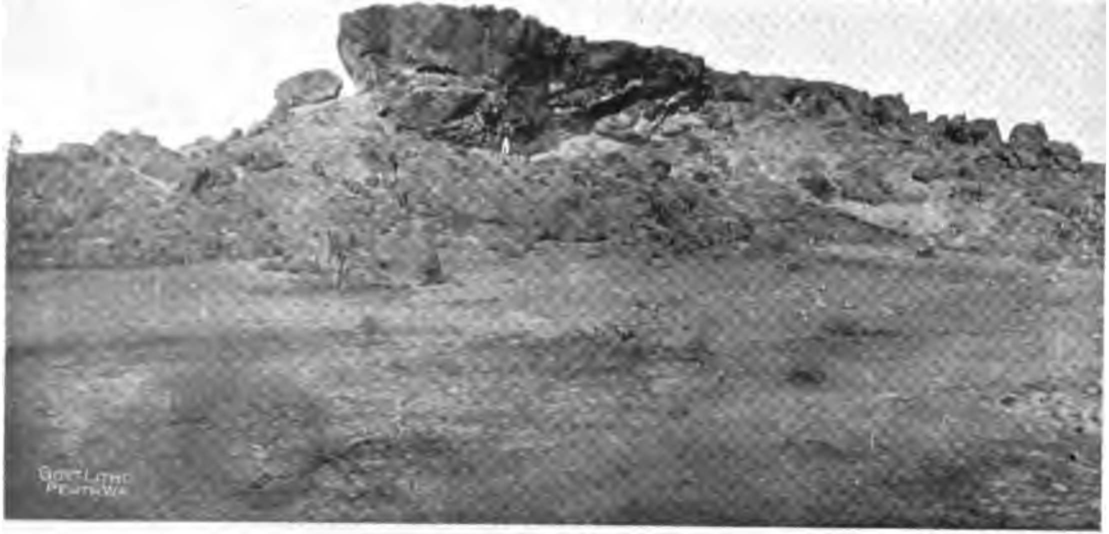


Photo. H. P. Woodward

LIBRARY
OF THE
UNIVERSITY
OF
CALIFORNIA

which owes its weather resisting character to iron oxide which has been drawn up in solution by capillary attraction through leaching of the rocks below.

These table top hills represent the ruins of a once extensive plateau, the whole of which was most probably covered by a ferruginous conglomerate, traces of which are still met with upon the tops of these hills, and in fragments around their bases.

The breaking up of these granite sheets was commenced by meteoric waters permeating surface cracks which were gradually cut out until they became stream channels or gorges. The hard crust having thus been penetrated and a cliff-like face exposed to the action of the weather, it only became a matter of time for the wind to slowly but surely dig into the softer gully beds, thus leaving the capping masses unsupported, when they naturally toppled over. In order to illustrate this action which is taking place to-day a series of photographs have been taken and reproduced ; the first, of the "flat top" (Photo. Nos 4 and 5), which shows the overhanging capping and soft underbeds and talus resulting from the ruin of the harder layer ; the second is of the "hanging rock" (Photo. No. 6), which illustrates how the last remnant of a hill capping is gradually travelling down a slope to the flat below ; and the third, called the "elephant rock" (Photo. No. 7), is of one of these masses which has safely alighted upon the flat, and all the *dêbris* of the softer beds having been removed the wind has now started to work around and under this boulder by removing it grain by grain as it frets away.

Dykes.—Dykes both acidic and basic are numerous in this district, intersecting both the granitic and the amphibolites. The basic, which are either epidiorite or fine grained grano-diorite, occur either parallel to the contact or radiate from it, following generally the same course as the quartz reef and occupying the same fissure; whilst the acidic, which are either felsites, quartz porphyries or granites follow no definite courses, but usually cross the other series at an obtuse angle (Photo. No. 8.)

Epidiorites.—From a point behind the hospital, which is at the south side of the town a line of disturbance extends in a south-westerly direction along the contact zone to the edge of the map. This consists of a magmatic intrusion, the rocks being either diorite or epidiorite, which latter probably results from the paramorphism of the diabase.

Volcanic.—The volcanic rocks proper occur just within the greenstone area along the contact zone a little to the eastward of the town upon the Cue Hill, from which point they extend both in a north-easterly and south-westerly direction forming a narrow belt of hill capping.

The Cue Hill itself is capped by a sheet flow of this hornblende andesite which in places is of a vesicular character, the cavities representing the gas or steam bubbles contained in the rock mass when it was in a molten state ; in some instances these cells have been filled with secondary minerals mostly quartz, when they may be classed as amygdaloids.

In these rocks the flow structure is often distinctly visible, whilst in others the weathered faces present a brecciated appearance which clearly indicates the cracking of the flow surface whilst cooling and its subsequent re-cementation.

Upon this hill there are two main dyke masses of this rock near its western base close to the railway line, these in all probability represent the necks up which the lava flowed ; whilst the crater, which would have risen to a considerable elevation above the hill top has been entirely removed.

These rocks although of absolutely no economic value in themselves may possibly have played a most important part in the formation of the fissures which contain the auriferous veins, since these not only radiate and dip in all directions from them, but also carry their highest values near them.

Clastic.—The clastic rocks are represented by a series of hill-cappings of quartzite and breccia which run for about 1¾ miles in a south-west direction from the racecourse, maintaining a distance of about one mile from and parallel to the contact zone.

Along this line between the various cappings, the surrounding flats are thickly strewn with fragments of boulders of the rocks, proving conclusively that this formation at one time formed a continuous sheet covering a considerable area which had a gradual fall to the south-west, representing in all probability an old valley in the grano-diorite tableland, into which highly siliceous thermal waters were discharged in the form of hot springs from the cooling volcanic region.

Laterites.—In this district laterites are of rare occurrence, and when they are met with it is as small hill-cappings, but to judge from the ferruginous nodules and traces of conglomerate met with upon the tops of the granite table hills, and the great extent, particularly in the north-western portion of this area over which detrital matter of a lateritic character is spread, this formation must in the past have covered a very considerable extent of country.

Recent.—Under the heading of recent and superficial deposits are included the alluvium of the creeks and flats, which is fairly extensive but of little thickness ; also the ferruginous cement, which is lateritic in nature but generally more or less detrital ; this latter may be only a few inches in thickness with protusion of weathered rock showing through here and there, or may attain a thickness of as much as six feet, in which case it is generally covered by a shallow alluvial deposit. Since it was found to be impossible to map in its

PHOTO. 6.

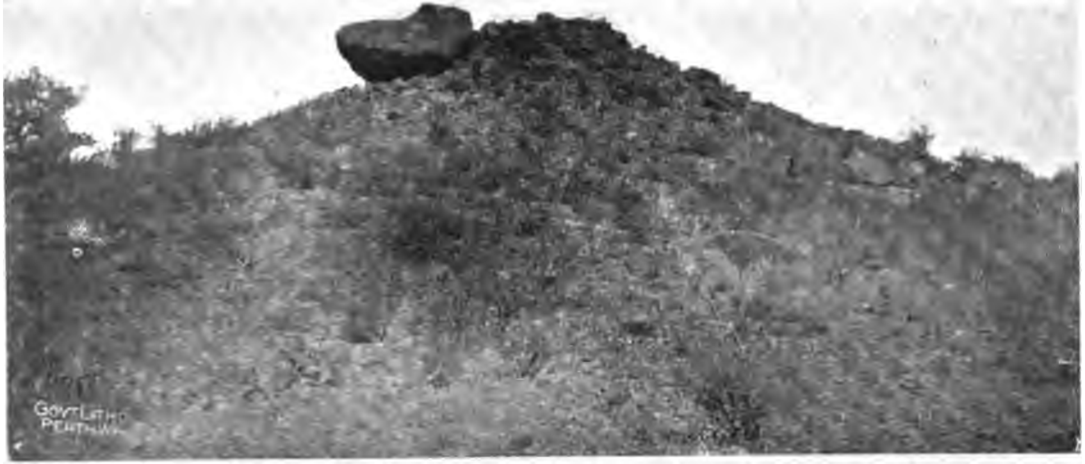


Photo., H. P. Woodward.

The Hanging Rock.

boundaries, it has been classed as rock when of little thickness with frequent rock outcrop, and as alluvium when thick and overlaid by clay or loam.

These deposits have proved to be of considerable economic value in places, for all the rich dryblowing patches belong to this group of superficial deposits, and usually occurring where this formation is very thin, bearly covering the weathered crystalline rock at points where they are intersected by numerous dykes and quartz reefs, the gold occurring as strewn rough particles or still united to fragments of its quartz matrix.

Quartz Reefs.—The main group of auriferous reefs near Cue are located within the grano-diorite area and may be classed under two headings. 1st, those which follow a course more or less parallel to the junction of these rocks with the amphibolites and dip in a northerly direction may be called *parallel contact veins* ; 2nd, those which radiate from the contact zone dipping generally in a westerly direction may be called *radiating reefs.*

These two classes of reefs so far as developments have proved differ very slightly in character, they rarely exceed a dip of 45 degrees, and invariably occupy a dyke fissure, and the quartz body is usually of a more or less lenticular character, whilst a number of these bodies may be so arranged as to present the appearance of a continuous line of outcrop a mile or more in length.

These lenticular bodies appear to be arranged with their longest axes inclined to the northward, which has given rise to the theory that the auriferous shoots dip in that direction.

In sinking one of these lenticular masses is met with below the other, sometimes being actually connected by a thin sheet of quartz, whilst in others small quartz veins may penetrate the dyke mass, in which case it is often found that the next make of stone is upon the opposite wall of the dyke.

The dyke masses themselves, which are of a basic nature, often carry a very considerable quantity of pyrites, but have so far in no instance proved of sufficient value in gold to be worth working.

Besides the two classes of reefs in the granite area referred to above, a series of what may be called flat reefs occur a little to the northward of the town beneath the "Patch," the rich dryblowing area from which a very large quantity of alluvial (?) gold was obtained.

These reefs are not of great richness, but owing to their size and the cheapness with which they can be worked they have been one of the mainstays of the district.

There is also a group of reefs to the north-westward of the area upon which a considerable quantity of work has been done, but these need no further description since they are identical with the radiating series.

In the amphibolite area there is about one-tenth of the auriferous reefs of this district, and these have yielded about one-twentieth of the total gold production. They for the most part follow a course fairly parallel to the contact, but do not present such long lines of outcrop as those in the granite, neither do they appear to follow dyke fissures.

In the radiating series the zone of enrichment has been supposed to generally dip to the northward upon the inclined plane of the lode, but since with one or two exceptions no work has been done below the water level, which would represent from 150 to 200 feet upon the underlay, very slight data is available upon which to arrive at a definite conclusion upon this point.

In two mines only at the present time are attempts being made to solve this important question : these are the Salisbury and the Cue No. 1, in the former of which a well-defined rich shoot of stone was worked down to the 200 feet level; this was supposed to dip from the surface to the northward, but upon driving north at the 250 feet level upon the lode no stone of value was cut, and upon investigation it was found that the rich stone pinched out a little below the 200 feet level.

The 250 feet level was then driven south, in which direction what appears to be a new make of stone was cut, and should this prove to be the case this new lens will lie directly below the first, and may thus form one of a series of lenticular masses, one below another, each individual body of which being inclined to the northward, but taken as a whole representing one shoot dipping in the same direction as the reef. (Fig. No. 1.)

Upon making further enquiries into the character of the vein worked in the upper levels it was discovered that no such thing as a continuous shoot of stone existed, since the upper portion of the rich reef was upon one side of the dyke mass and the lower upon the other, therefore it is clear that two distinct lenses have already been worked, but since the upper workings are inaccessible it is impossible to investigate into their characters.

In the case of the Cue No. 1, which was originally worked by a company until their managers supposed all the payable stone worked out recommended its abandonment, when it passed into the hands of the present owners, who discovered another body of stone of equal size and richness to that already worked. This in time also gave out, after which no attempt was made to prospect for a fresh body below the No. 4 level, with the exception of one winze, in which it is stated certain values were met with. However a new main shaft was sunk at a considerable distance to the dip which cut the reef at a depth of 530 feet from the surface, the latter being then driven upon for a considerable distance both north and south without results.

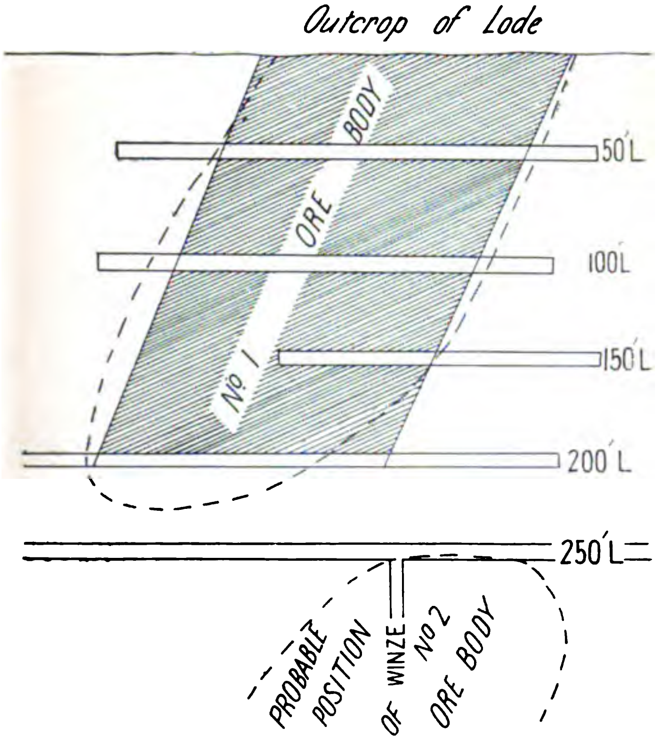


FIG I

DIAGRAM OF THE SALISBURY MINE

PLAN UPON LODE PLANE

STOPED........................ ▨

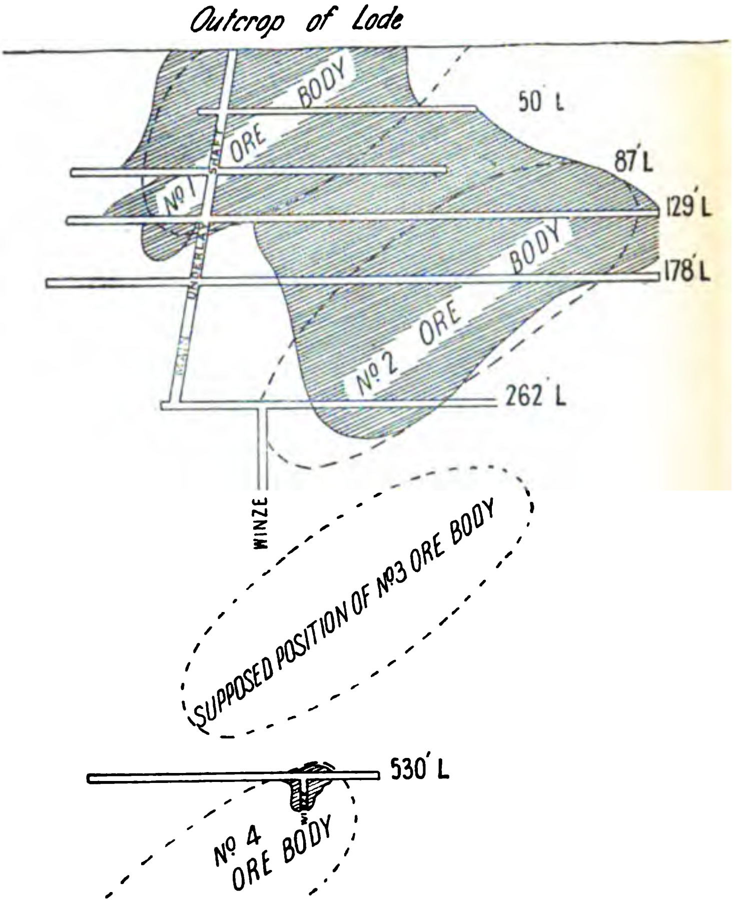


FIG. II

DIAGRAM OF THE CUE No 1 MINE

PLAN UPON LODE PLANE

STOPED:........................... ▨

LIBRARY
OF THE
UNIVERSITY
OF
CALIFORNIA

Like the Salisbury mine, the old upper workings in this mine are inaccessible, whilst no surveyed plan exists of the work done since the days of the company, therefore it is impossible to express a definite opinion as to what has taken place, the only point which seems clear is that at least two distinct lenses were worked in the upper levels, the lower of which died out just below the No. 4 level ; this being the case it would have been wiser to have sunk three or four more winzes from the bottom level for a distance of 50 feet each upon the lode before undertaking the work now in hand.

It is quite possible that the 530 feet level now being driven may have passed between two lenses of quartz, and that the stone carrying values now being winzed upon north of the shaft may prove to be the apex of a new make ; should this prove to be the case it is quite possible that another lens exists above this level between it and the No. 4. (Fig. 2.)

Another question that deserves attention is that of the sheet reefs below the "Patch," for since these exist one below another it is only reasonable to suppose that others underlying them will also exist and prove to carry values, and should this prove to be the case it will be of very great importance to the district. This question could be simply and cheaply tested by a series of bore holes put down to a depth of about 250 feet at points where the existing reefs have proved to be richest.

Some boring has been done to a considerable depth upon the westward side of the "Patch" and the northward of the Cue No. 1, but from only one of these are any values reported, whilst these, although high, do not appear to be very authentic since the company had not sufficient confidence in it to test it by shaft sinking.

Alluvial deposits.—Correctly speaking there are no alluvial deposits which contain gold in this district, but several extensive patches over which the detrital matter from rocks and reefs has been spread have proved highly remunerative to work. From these a very considerable quantity of gold was won in the early days of this field, in fact it was due to the discovery of one of these that attention was first directed to this locality. It is quite impossible to form any idea with regard to the quantity of gold obtained from these deposits since no official record was kept prior to 1896, by which date the greatest number and the richest of them were practically worked out.

The original main deposit, known as the "Patch," which is situated upon the northern boundary of the township of Cue, was very productive, the gold occurring in a quartz-strewn formation which rarely exceeded one foot in thickness. It was usually of a ragged or flaky character and often attached to fragments of quartz, which clearly demonstrated that it had not been subjected to the concentrating action of running water.

Considerable prospecting was done upon the outcropping reefs from which it was supposed to have been shed, but these as a rule proved to be either of low-grade or barren, and it was not until the nature of the area was more clearly demonstrated that any solution as to its origin could be propounded.

With the development of the reefs, however, it was discovered that a series of horizontal payable quartz bodies extended beneath this area, therefore it is quite possible that another such body, although in all probability much richer, existed above them, and that it was from the disintegration of this flat upper reef *in situ* that the gold and quartz found upon the surface were derived, the smaller and lighter particles of rock and quartz having been removed by the action of the wind.

The origin of the gold upon the "Pearling Ground" is by no means so clear, since there is no indication in this locality of the existence of flat reefs, whilst the reefs that do outcrop, although sometimes found to contain phenomenally rich patches, have never developed into consistently payable properties. Owing, however, to the fact that so much of the gold that was discovered was large and rough and often still adhered to or was contained in fragments and lumps of quartz, it is clear that this deposit was not formed by gradual concentration from the detritus of rocks and reefs containing minute quantities of fine gold, but from the disintegration of quartz veins of considerable richness.

The other smaller deposits in this district resemble more closely the ordinary dry-blowing patches met with upon the Eastern Goldfields, the presence of the gold being easily accounted for by the concentrations from weathered rock containing small veins of auriferous quartz.

It will be seen from the above that although this district owed its start to the richness of these deposits, they have not so far led directly to the discovery of any payable reefs.

General.—From a careful examination it would appear that the amphibolite series represents the oldest rocks of this district, but whether their origin was igneous or sedimentary it is impossible to say ; judging, however, from the nature of that portion which remains, they were probably of igneous origin, because neither calcareous nor arenaceous beds are met with, which would be the case if they resulted from metamorphised sedimentary rocks.

Next in antiquity to the amphibolites come the epidiorites, which are of undoubted igneous origin ; then the granodiorites, which occur as a magmatic intrusion, causing a certain amount of regional metamorphism to take place in the basic series along the contact zone. During the period of cooling these rocks appear to have cracked, whilst into the fissures thus formed molten matter was intruded, which although of the same character as the granodiorite cooled more rapidly and in consequence formed a finer grained rock.

PHOTO. 7.

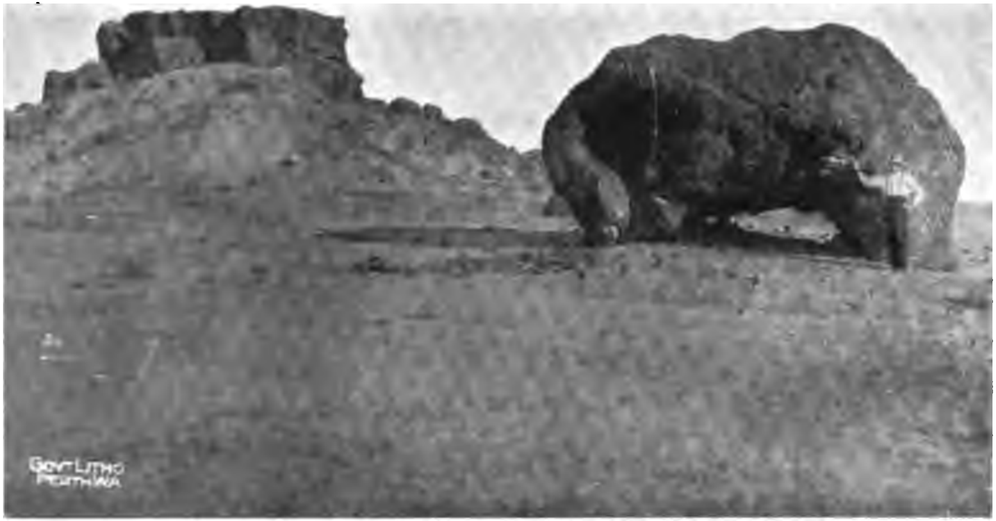


Photo., H. P. Woodward.

The Elephant Rock.

At some later period the pent-up forces of nature took advantage of the line of weakness at the contact of the amphibolites with the granodiorites and burst forth as a volcanic eruption at a point somewhere near the present Cue hill, remnants of the lava poured out are still upon the top of the hill, which at that time in all probability represented the level of the country.

These eruptions would in all probability extend over a considerable period, during which the dyke fissure lines would be subjected to considerable vibration if not actual movement, whilst later, as the internal heated mass began to cool, shrinkage and subsidence would take place accompanied by movement along these lines, with considerable grinding along the walls of the fissures, particularly when convex surfaces were brought together, and a corresponding opening out where concave surfaces were opposed.

Later on these cavities were filled by the deposition of silica and other minerals from the heated waters which traversed them, and these in time became the quartz reefs of to-day which lie upon one or the other wall, as the case may be, or cross the dykes at points where they have been crushed or broken. At some later period another series of irregular fissures were formed which were filled with felspathic material now forming the quartz porphyry dykes which intersect indiscriminately rocks, dykes, and quartz reefs without apparently producing any other influence upon them than perhaps a slight throw or faulting.

Some time during the later stages of cooling, but subsequently to the formation of the quartz reefs, a certain amount of hydrothermal action must have taken place which formed the large sheet of secondary silica breccia, the remnants of which are represented to-day by small hill cappings and strewn fragments.

Since the period of volcanic activity, denudation has steadily but surely been at work removing all vestiges of what must have been a volcanic crater, leaving now only the dyke-like mass representing the vent up which the lava was forced, which is now at an elevation considerably below the flow which caps the hills.

This denuding action appears to have proceeded until the auriferous portions of the reefs were reached, for had the removed portions contained gold, large and rich deposits would have been accumulated in the alluvium, whereas the only superficial deposits (incorrectly classed under the name of alluvial) in this district that carry gold are of a distinctly æolian detrital character, the gold occurring upon the surface of the ground either in the form of ragged pieces or still associated with its quartz matrix.

Summary.—In conclusion it may be stated that the reefs of this district are of the fissure type, in which fissures, also, considerable movement has taken place, as is proved by the polished and striated walls and ground-up rock material between them and the reef.

Since these fissures contain dykes of igneous origin, their extent in depth may be looked upon as considerable.

Whilst the reefs themselves, where opened up and worked, have proved to be of considerable value, but not to consist of one continuous body but a series of lenticular masses, the relation of which to one another it is impossible at the present time to determine, owing to the fact that they were not studied at the time they were accessible, therefore the prospecting for the lost shoots at the lower levels has to be carried out in a more costly manner than would have been necessary had more accurate information been available about those portions of the reefs already worked.

SECTION II.—THE MINES OF CUE.

GENERAL.

The general character of the ore deposits of this district having been fully dealt with in Section I. of this report, the following portion is devoted solely to a more or less detailed description of the individual mines, including their production, size, and character of the ore body, nature of the enclosing rock, depth of water level with quantity and quality, and the extent of the workings, plant, etc., the whole being accompanied where possible by mine plans and sections.

The collection and compilation of this information has necessarily entailed a very considerable amount of time and labour, because out of the 90 reefs described only 30 are held at the present time, whilst out of this number, only 25 were being worked during 1906.

Information regarding the underground workings of abandoned and inaccessible mines, which could only be inspected at the surface, has been in part obtained from the following official resources :—"Report on the Interior Gold Regions of W.A." by S. Goczel, Field Geologist, Department of Mines, 1894 ; "Annual Reports of Frank Reed, Inspector of Mines, Central Goldfield, 1895-6" ; "Bulletin of the Geological Survey Department No. 7" ; "Auriferous Reefs of Cue and Day Dawn," by W. D. Campbell, Assistant Geologist, 1903, supplemented by that kindly supplied by Messrs. Cheeson, Hayden, and Lloyd.

In order to verify the information gathered from these various sources, the plans of the underground workings were consulted when obtainable, but when these did not exist a careful surface examina-

PHOTO. 8.

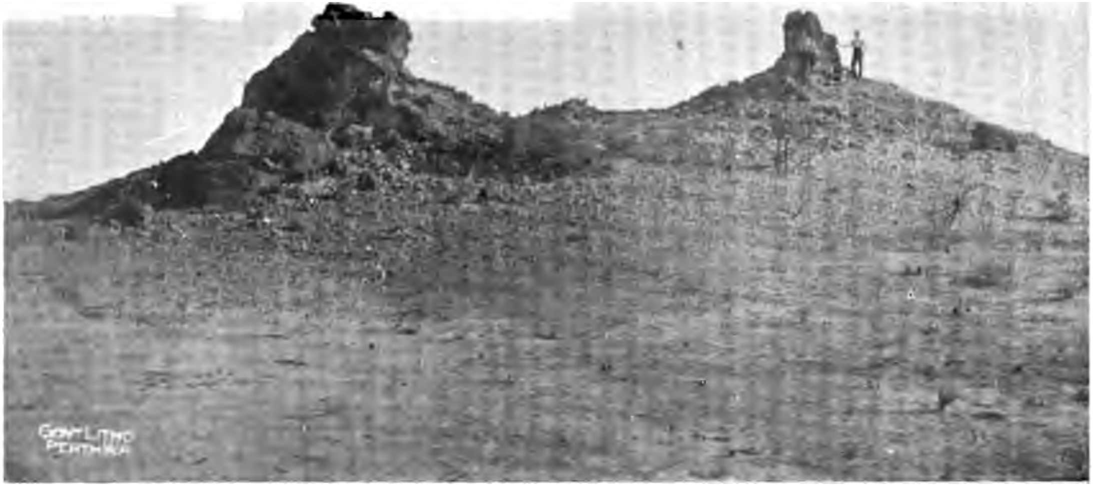


Photo., H. P. Woodward.

The Pinnacles.

tion was made, due consideration being given to the tonnage of stone reported to have been raised as set forth in the official statistics.

When possible, plans of the underground workings were secured, either by actual survey or from the owners, which, together with those already in the record office of this Department, have been reproduced in order to make the context as intelligible as possible ; but as a number of these were made many years ago it is highly probable that they are not up to date, since many of the mines have been worked between the time of their abandonment by the original companies and the present.

All the figures in the tables of production have been obtained from the Statistical branch of the Mines Department, but owing to the fact that this field was discovered in the year 1891, and that it was not until 1897 that it became compulsory for owners of leases to report monthly to the Government the quantity of the stone treated with the yield of gold therefrom in ounces, therefore little reliance can be placed upon figures relating to returns prior to the latter date.

Some of the early records include the returns not only from a group of mines worked by one company, but often from those situated at a considerable distance when belonging to the same owners, and this renders it quite impossible to arrive at anything like a reliable estimate of the individual production.

At the end of 1906 there were 58 gold mining leases in force in this portion of the district, but of these only 25 were productive, the balance being held either for area or to secure the underlay of the reef at a depth.

Owing to the heavy cost of working mines in the early days before this district was connected by a railway many were abandoned, which under the more favourable conditions existing at the present should pay well to work, therefore with the object of stimulating the gold mining industry a system has recently been inaugurated of publishing a list of the abandoned leases in each district together with their yield ; this list, although of considerable interest and value, does not go quite far enough since many of the reefs from which gold was won in the past have been abandoned and taken up again, and are now being worked either under other names or even in some instances the same name but with different lease numbers, although the original leases show as abandoned in the list.

In order to illustrate this a reference to the following table of productive leases (p. 74) will make it clear that there have been 161 of such at one time or another in this district, whilst out of this number 131 are shown as abandoned and 30 as existing, now as there are only about 90 reefs from which gold has been won it follows that many of these leases refer to the same area, and in fact at the present time no less than 22 are being worked as new leases.

There are also instances of reefs being held, worked and abandoned, and taken up again several times, in which case a number of abandoned leases under a variety of names and numbers appear in the list * the production from each as shown represents only the yield for the period during which the individual lease was in force, and nothing appearing to identify them as a consequence the gross total cannot be easily arrived at.

With the object of showing the individual total production of each reef, a table follows the description of each mine in which, year by year, the quantity of stone crushed and the yield of gold therefrom is given together with the name and number of the gold mining lease under which the area was held and worked, and by this means the total production of any one reef may be seen at a glance.

Prior to 1897, a very considerable quantity of alluvial gold was obtained in this district, but since this is included in the grand total of the gold yield from the whole of the Murchison it is impossible to determine the actual quantity obtained from this locality.

The order observed in the description of these reefs has been arrived at by starting at the north-west corner of the Geological plan and working south, then taking the main central Cue group, next those lying to the north-eastward, and last those within the amphibolite area to the south-east and south.

DESCRIPTION OF THE MINES.

The Union Jack, G.M.L. 1129 (abandoned).—This extinct lease is situated about three miles to the north-westward of Cue, and upon it a number of shallow shafts were sunk some years ago along a quartz blow which strikes in an east-north-east direction dipping to the north-westward, the country rock being kaolinised granodiorite.

It has been twice held as a lease, first in 1897 when 55 tons of stone were crushed which yielded 16.46 ounces of fine gold, whilst it was again taken up in 1901, when 53 tons of stone yielded 17.88 ounces of fine gold, or a total of 108 tons for 34.34 ounces, which is at the rate of .32 ounces per ton.

Since the last crushing was taken, the surface has been worked over by dryblowers, but there is no record of the quantity of gold obtained.

Retreat, late Duke of York, G.M.L. 1022 (abandoned).—This is a parallel reef about 12 chains to the north-westward of that last described, and upon it a number of shallow shafts have been sunk in weathered granite. It was first held and worked as the Duke of York prior to 1897, and 30 tons are reported to have yielded 27.15 ounces of fine gold, it was again taken up as the Retreat in 1902-3, when 45 tons yielded 23.01 ounces of fine gold, or a total of 75 tons for 50 ounces, which is at the rate of .67 ounces per ton.

---

*See Gem of Murchison p. 31, and Lily p. 36.

Stanmore G.M.L. 887 (abandoned).—Some time prior to the year 1897, this area was secured by an English company, who did a considerable quantity of work upon a reef which strikes in a north-easterly direction dipping to the north-westward.

The country is weathered grano-diorite, but a basic dyke crosses the lode upon a more easterly course, this dyke was cut both in one of the underlay shafts, and also in a deep vertical shaft sunk to intersect the vein at a depth [**6862**].

In all 63 tons of stone were crushed which yielded 59.73 ounces of fine gold, being at the rate of .94 ounces per ton, therefore with the loss in the sands this stone must have been worth more than an ounce.

The Mafekin and Hard Luck G.M.L's. 1159, 1175 (abandoned).—A little to the south-westward of the Union Jack is the Mafekin, which is now used as a well by the lessee of the grazing right for watering cattle.

It was originally held as two leases under the names given above, but in 1902 these were amalgamated and worked under the former up till 1904.

A number of shafts have been sunk upon the reef which strikes north-east and dips to the north-west, the country rock being decomposed grano-diorite. These shafts have been sunk to a depth of 90 feet which is the water level, and the vein which varies from 3 inches to 5 feet in width has been driven upon for a length of 200 feet and stoped to the surface. Later on a new main vertical shaft was sunk a little south of the old workings to a depth of 200 feet, but since a supply of fresh water equal to 200,000 gallons per diem was struck, sinking was discarded, and a crosscut driven 32 feet east to the reef which was driven upon for a distance of 30 feet north and 50 feet south, and risen upon some 35 to 40 feet.

The return of the stone treated is as follows :—

Table showing the Yield of the Mafekin Reef.

Year.	Name and Number of Lease.	Ore crushed.	Gold therefrom.	Rate per Ton
		tons.	ozs.	ozs
1899	Hard Luck, G.M.L. 1159	50·00	28·99	·57
1900	Do do.	46·00	26·82	·58
1900	Mafekin, G.M.L. 1175	58·00	56·02	·96
1901	Do. do.	39·00	28·40	·73
1902	Mafekin, G.M.L. 1139	71·00	20·12	·28
1903	Do. do.	17·00	1·65	·09
1904	Do. do.	50·00	3·85	·05
	Total	**331·00**	**165·85**	**·50**

The sands from these crushings are said to have yielded 7dwts. of gold per ton when treated by cyanide later on, if this is so it would bring the value up to about .75ozs. per ton for the stone crushed.

The Monte Carlo, G.M.L. 1530.—Adjoining the Mafekin upon the east is a parallel reef in kaolinised granite which is being worked by a series of shallow shafts in the soft country.

The quartz is of a white glassy nature sometimes showing grains of gold in cubical cavities from which pyrites has evidently been leached, but of which no trace remains, not even iron stains.

During the year 338 tons of stone have been raised and treated with the result that 198.46 ounces of fine gold were obtained, or at a rate of a little over half an ounce per ton.

City of St. Petersburg G.M.L. 764 (abandoned).—About a quarter of a mile in a south-easterly direction from the Monte Carlo are some old workings upon a reef which apparently has a north-easterly course and dips to the north-westward. The country, judging from the dumps, seems to have been a decomposed hornblende schist representing in all probability one of the greenstone dykes which so commonly accompany the reefs in this district. [6863.]

This mine was worked before the year 1897 under the name of St. Petersburg, but during that year and the following it was called the Lady Godiva.

Table showing the Yield of the City of St. Petersburg Reef.

Year.	Name and Number of Lease.	Ore crushed.	Gold therefrom.	Rate per ton.
		tons.	ozs.	ozs.
1896	City of St. Petersburg, G.M.L. 764 ...	10·00	4·52	·45
1897	Lady Godiva G.M.L. 1116	30·00	22·81	·76
1898	Do. do.	177·00	91·35	·51
	Total	**217·00**	**118·68**	**·55**

The Two Nations G.M.L. 865. (abandoned).—Adjoining these last-mentioned leases to the south-westward are some more old workings from which there is a record of 10 tons having been crushed in the early days of the field which yielded 9.05ozs. of fine gold.

The Kangaroo G.M.L. 672 (abandoned), Plate 1.—This mine is situated upon the same line of country and about half a mile south-west of a reef striking in a north-easterly direction dipping to the north-westward at an angle of about 48 degrees, and varies from a few inches to five feet in thickness.

Upon this reef a main underlay shaft has been sunk to a depth of 240 feet, from which a level at 75 feet from the surface was driven for a distance of 150 feet south and 114 feet north to the air shaft, and for a further distance north of 186 feet. A second level was driven at 110 feet (water level) for a distance of 22 feet north.

All the stoping has been done between the upper level and the surface, a spur or cross reef strikes off from the hanging wall side of the lode having a more westerly course, and upon it a vertical shaft has been sunk, cutting it at a depth of 90 feet where it was driven upon for a distance of 45 feet.

Table showing the Yield of the Kangaroo Reef.

Year.	Name and Number of Lease.	Ore crushed.	Gold therefrom.	Rate per ton.
		tons.	ozs.	ozs.
1897	Kangaroo, G.M.L. 672	253·00	130·79	·51
1898	Do. 672	56·00	28·01	·50
1899	Do. 672	9·00	2·71	·30
1902	Do. 1306	160·00	97·95	·61
1903	Do. 1306	294·50	185·18	·62
1904	Hard Nails, G.M.L. 1439	13·50	11·05	·81
1905	Do. 1439	33·00	12·13	·37
	Total	**819·00**	**467·82**	**·57**

Between the years 1897-9 it was worked by a company who had a 10-head stamper mill and other machinery, after which it was not worked for two years when it was again taken up by a local syndicate who worked it for a further period of two years. In 1904-5 a small portion covering the old workings was taken up under the name of Hard Nails, but at the present time all work has ceased. The early results do not include sands treatment, which are reported to have yielded by cyanidation at a later date 3dwts. 3 grains per ton, which would bring the average up to well above the half-ounce of fine gold per ton.

The Leviathan G.M.L. 183 (abandoned), Plate II.—This lease adjoins the Kangaroo upon the south-west side, the reef being apparently contained within the same line of fissure, but the quartz vein is not continuous.

The mine has been opened upon a large quartz blow, which strikes north-north-east and dips to the westward at an angle of 50 degrees. The reef lies between a greenstone footwall and a grano-diorite hanging wall, it varies in thickness from 2 to 10 feet and has been followed down by an underlay shaft to a depth of 260 feet, where it is from 6 to 7 feet in width carrying a little galena.

The No. 1 level was driven at 50 feet from the surface for a distance of 30 feet north and 110 feet south to the No. 2 shaft, then on for another 40 feet to the No. 3 shaft. Above this level for the last 100 feet at the southern end all the stone has been stoped to the surface.

The No. 2 level has been driven at 185 feet from the surface for a distance of 10 feet north and 110 feet south to the No. 2 shaft, but only a small stope has been carried up above this level to a height of 50 feet and for a length of 25 feet. The No. 3 level was driven at a depth of 235 feet for a distance of 40 feet south, and a rise put up to the No. 2 level.

It was worked continuously by a company from 1897 to 1902, who had certain plant upon the mine, after which it was worked by local people for two years as the New Leviathan.

Table showing the Yield of the Leviathan Reef.

Year.	Name and Number of Lease.	Ore crushed.	Gold therefrom.	Rate per ton.
		tons.	ozs.	ozs.
1897	Leviathan G.M.L. 183	130·00	107·01	·82
1898	Do. do.	246·00	173·98	·70
1899	Do. do.	237·00	181·78	·76
1900	Do. do.	330·00	263·67	·79
1901	Do. do.	43·00	26·95	·62
1902	Do. do.	162·50	96·01	·59
1903	New Leviathan G.M.L. 1390	259·00	94·56	·36
1904	Do. do.	47·00	79·95	1·70
	Total	**1,454·50**	**1,023·91**	**·70**

There is no record of the sands treated, but they are said to have yielded 5dwts. per ton, which would bring the total up to close upon an ounce of fine gold per ton of stone crushed.

The George Higginbotham G.M.L. 178 (abandoned). — This old mine, which was worked from 1898 to 1900, adjoins the Leviathan to the south-westward, and is apparently upon the same main line of fissure, which is traversed by the basic dyke mentioned in the description of that mine. The country here appears to be broken and disturbed by cross pegmatic dykes [3799], and as a consequence the quartz reef which strikes in a north-easterly direction and dips to the westward at an angle of 70 degrees cannot be traced for any considerable distance.

It has been opened upon by two underlay shafts, a vertical shaft and an open cut, but no information is available as to their depth or the size of the reef.

Table showing the Yield of the George Higginbotham Reef.

Year.	Name and Number of Lease.	Ore crushed.	Gold therefrom.	Rate per ton.
		tons.	ozs.	ozs.
1898	George Higginbotham G.M.L. 178 ...	46·50	11·70	·25
1899	Do. do. do. 178 ...	104·00	30·37	·29
1900	Do. do. do. 178 ...	27·50	37·73	1·37
	Total	**178·00**	**79·80**	**·44**

Upon the eastern side of the ridge formed by the quartz blow in the Leviathan lease a small dryblowing patch extends in a southerly direction, crossing the north-east corner of this George Higginbotham lease, whilst the south end of the reef upon the last-mentioned lease is covered by a large dryblowing patch from which a long narrow strip extends in a north-westerly direction for a distance of 35 chains, and a large wide patch southerly and westerly over the Argus lease in the direction of the Lombardy mine for a distance of 20 chains.

The Argus G.M.L. 1328, *Gem of Murchison* (abandoned).—This lease was formerly known as the Independent G.M.L.173, and formed a portion of the property owned by a company called the Gem of Murchison G.M. Ltd., who erected a 10-head mill and other mining plant upon this lease, whilst another 10-head was upon the ground, but not put up.

The area lies immediately to the south-westward of the George Higginbotham, and is apparently upon the same line of fissure ut as at this end the reef is considerably broken and of little value, only a small amount of prospecting has been done upon it, he main developments being upon a series of parallel north and outh reefs lying as contact veins with quartz porphyry dykes 856], which came in from the Gem G.M.L. 538 at an angle to e main line.

These reefs, which have a northerly course and dip at an ngle of 50 degrees to the eastward, have been prospected by a main vertical shaft sunk in the grano-diorite [6850], and a number f underlay shafts, many of the latter being in the adjoining lease, portion of which is still held as the Little Gem.

This is an instance in which an area at present held will be hown in the returns as five abandoned leases.

Table showing the Yield of the Gem of Murchison Reef.

Year.	Name and Number of Lease.	Ore crushed.	Gold therefrom.	Rate per ton.
		tons.	ozs.	ozs.
1897	Gem of Murchison G.M.L. 538 ...	60·00	35·67	·59
1900	Gem G.M.L. 1216	32·00	14·60	·46
1900	Golden Gem G.M.L. 1220	10·00	4·74	·47
1902	New Gem of Murchison G.M.L. 1314	39·00	21·35	·54
1902	Argus G.M.L. 1328	142·00	102·02	·71
1903	Do. 1328	352·00	225·14	·64
1904	Do. 1328	326·00	180·68	·55
1905	Do. 1328	256·30	153·55	·59
1906	Do. 1328	56·00	18·13	·32
1906	Little Gem G.M.L. 1542	64·00	62·84	·98
	Total	**1,337·30**	**818·72**	**·61**

Although this production is not entirely from the same it is from the same reefs, and therefore they have been tak gether.

The Lombardy G.M.L. 1034 (abandoned).—Upon this which is situated about 30 chains west of the Gem of Mur the British investors expended a considerable sum in the pu and erection of plant, etc., before testing the lode. The re the normal north-easterly strike dipping at an angle of 50 d to the north-westward and is, to judge from the dumps, pro a contact vein with a basic dyke upon one or the other associated with a considerable quantity of pyrites and calcite.

It was developed by an underlay shaft to a depth of 260 but no plans are in existence or information available as t extent of the workings.

Table showing the Yield of the Lombardy Reef.

Year.	Name and Number of Lease.	Ore crushed.	Gold therefrom.	pe
		tons.	ozs.	
1897	Lombardy G.M.L. 1034	210·00	126·22	
1898	Do. 1034	135·00	31·47	
1900	Do. 1034	Sands	57·48	
	Total	**345·00**	**215·17**	

The Jubilee, G.M.L. 1511 (Plate III.).—This mine is sit about three-quarters of a mile to the north-westward of the bardy. The reef strikes north-west and dips at an angle o degrees to the south-west. It was originally worked by an unde shaft to a vertical depth of 90 feet, from the bottom of whic level was driven for a distance of 30 feet to the south-east, wh another level was driven at a depth of 45 feet from the surface a distance of 120 feet south-east.

Later on a vertical shaft was sunk at a distance of 150 south of the underlay shaft to a depth of 83 feet, which is the w level. From this shaft a rise was put up to the end of the 45 level, and a level driven at the bottom 50 feet north-west and 40 south-east, from which level the ore has been stoped up to surface.

A large porphyritic acid dyke accompanies this lode, whi called formation, and since it carries a little gold from 8 to 9 fe it has been worked with the stone.

LIBRARY
OF THE
UNIVERSITY
OF
CALIFORNIA

Table showing the Yield of the Jubilee Reef.

Year.	Name and Number of Lease.	Ore crushed.	Gold therefrom.	Rate per ton.
		tons.	ozs.	ozs.
1897	Jubilee G.M.L. 1117	105·00	64·39	·61
1898	Do 1117	744·00	230·03	·30
1900	Do 1168	12·50	7·85	·62
1905	Do 1511	170·00	53·62	·31
1906	Do 1511	79·00	22·30	·28
	Total	**1,110·50**	**378·19**	**·34**

Highland Mary, G.M.L. 718 (abandoned).—This lease was situated upon the north side of the Gem of Murchison, the reef having the normal north-easterly strike and underlay to the westward, following a basic dyke fissure parallel to the Leviathan line. A few shallow shafts were sunk in 1897, from which 68 tons of stone were crushed which yielded 7.32ozs. of fine gold, or at the rate of about 2dwts. per ton.

Golden Leaf, G.M.L. 889 (abandoned).—This is about 20 chains to the south-eastward of the Gem of Murchison; the reef strikes in a north-easterly direction and dips to the north-east. It has not been worked since 1896, when 33 tons of stone were crushed which yielded 42.54 ounces of fine gold, or a little over one ounce per ton.

Battler's Hope, G.M.L. 1284 (abandoned).—These old workings are situated about half a-mile to the southward of the Gem of Murchison. There are two lines of reef which strike north-west and dip at a low angle to the south-west.

Upon the eastern of these a considerable amount of prospecting has been done, several vertical shafts having been sunk in decomposed grano-diorite, the deepest of which is about 30 feet

This area was held during the year 1901, when 30 tons of stone were raised and treated, yielding 8.49 ounces of fine gold, which is at the rate of .28 ounces per ton.

Red, White, and Blue, G.M.L 745 (abandoned).—This mine is situated about half a-mile due east from the George Higginbotham, and was worked until 1899 by a company who erected a 20-head stamper mill and other mining machinery, and did a considerable amount of development work.

The reef strikes in a north-easterly direction and dips at an angle of 55 degrees to the north-westward, being associated both with a basic and porphyritic dyke, the former, which often contains a considerable quantity of pyrites, being chloritic or epidote schist [6857-61, 3800-4].

A main shaft has been sunk to a vertical depth of 200 feet with a drive 300 feet north and 301 feet south, the reef varying in width from 1 to 7 feet, and pinching out entirely at the ends the level.

There are also two underlay shafts, 90 feet in depth, which a connected by a drive 100 feet in length in which the reef averag 3 feet in width, and it is above this level that the stopes have be carried up to the surface.

A small portion of this area, embracing the old workings, taken up by local men and worked during this year, 1905, as Little Sparkler.

Table showing the Yield of the Red, White, and Blue Reef.

Year.	Name and Number of Lease.	Ore crushed.	Gold therefrom.	R per
		tons.	ozs.	
1896	Red. White, and Blue G.M.L. 745 ...	100·00	89·06	
1897	Do. do. do. ...	241·00	93·65	
1898	Do. do. do. ...	737·00	301·30	
1899	Do. do. do. ...	25·00	6·92	
1905	Little Sparkler G.M.L. 745	61·00	37·48	
1906	Do. do.	13·50	9·32	
	Total	**1,177·50**	**537·73**	

There is no record of the value of the sands treated, s quently, but it may be assumed that they would have brough gross returns up to over half an ounce of fine gold.

The Victory, G.M.L., 1354, *late Buttercup* (abandoned).- old mine is situated upon the south side of the Cue-Cudding Road, near the two-mile post.

The reef strikes in a north-westerly direction dipping north-east, upon which a number of shallow shafts have bee in kaolinised granite.

Table showing the Yield of the Buttercup Reef.

Year.	Name and Number of Lease.	Ore crushed.	Gold therefrom.
		tons.	ozs.
1897	Buttercup G.M.L. 1109	100·00	58·54
1903	Victory G.M.L. 1354	249·50	133·64
1904	Do. do. 1354	242·00	101·80
1905	Do. do. 1354	12·00	7·30
	Total	**603·50**	**301·28**

The Victoria, G.M.L. 1177 (abandoned).—This reef is upon the Cue telegraph line at a distance of one mile f town; it has an almost north to south course with an und the westward.

A number of shafts have been sunk upon it, the deepest of which is 110 feet (water level) in decomposed granite. At this depth a level has been driven for a distance of 200 feet and a winze sunk 75 feet. In the upper workings the reef varies from 1 foot 6 inches to 3 feet in width, containing small veins and strings of quartz.

This line of fissure is evidently traversed by a basic dyke which is intersected by a large series of porphyritic dykes that may be seen outcropping at the surface and crossing it at an angle of about 45 degrees [**6875, 3805**].

Table showing the Yield of the Victoria Reef.

Year.	Name and Number of Lease.	Ore crushed.	Gold therefrom.	Rate per ton.
		tons.	ozs.	ozs.
1896	North Victoria G.M.L. 817	203·00	283·00	1·39
1897	Vicioria G.M.L. 1118	11·00	22·55	2·05
1898	Do. do. 1118	52·50	329·07	6·34
1900	Do. do. 1177	11·00	6·61	·60
	Total	**277·50**	**641·23**	**2·31**

The Lily, G.M.L. 1494 (abandoned).—This lease was situated about 30 chains due west of the Cue township boundary, and embraced a number of extinct leases which have been held under various names since the year 1894, when 63 tons of stone are reported to have been crushed yielding 214 ounces of gold by battery treatment only.

There is a main reef which strikes a little east of north and dips at an angle of 75 degrees to the westward, it is generally small in size, varying from 6 inches to 2 feet in width, but is of high grade.

The southern end of this reef was worked continuously from the year 1897 to 1904 under the name of the Deceiver, G.M.L. 1115, but the northern portion has been known as the Lily, Two Lilies, Deceiver North, etc.

In the years 1902-3 the whole area was provisionally amalgamated and a local company formed, called the Brilliant G.M., N L., with the object of sinking a main shaft to the dip and south-w rd to cut the shoot of stone at a depth. This shaft was sunk t a depth of 200 feet and the reef driven on for a distance of 66 f t, 46 tons of stone being crushed which yielded 14.54 ounces of fi gold, or a little over 6dwts. to the ton, which would not pay u n so small a body of stone.

In the old workings the reef has been driven on for a length o 60 feet at the water level which is 116 feet from the surface below this level; the stone has been stoped for a depth of 30 feet and a length of 400 feet, this stope being carried up to the surface.

In the upper workings the rock is much weathered but the vein appears to be associated with a porphyritic acidic dyke which was also met with in the solid state in the deep vertical shaft which was sunk in grano-diorite [6878-9].

It will be seen from the accompanying return that this vein has yielded 2,700 tons of stone which has averaged over 1¼ ounces of fine gold to the ton, whilst the sands from the early crushings are said to have been extremely rich. This is another instance in which seven abandoned leases cover practically the same area and have all been worked upon the same reef and same shoot of stone.

Table showing the Yield of the Lily Reef.

Year.	Name and Number of Lease.	Ore crushed.	Gold therefrom.	Rate per ton.	Total. Ore crushed.	Total. Gold therefrom.	
		tons.	ozs.	ozs.	tons.	ozs.	ozs.
Prior to 1897	Lily G.M.L. 701 (119) ...	480·00	724·03	1·50	623·00	869·92	1.39
„ 1897	Do. 701 (119) ...	128·00	134·68	1·04			
„ 1898	Do. 701 (119) ...	15·00	11·21	·74			
„ 1897	Two Lillies G.M.L. 1113 ...	55·00	66·88	1·21	180·00	172·30	·95
„ 1898	Do. do. 1113 ...	35·00	19·27	·55			
„ 1899	Do. do. 1113 ...	90·00	86·15	·95			
„ 1900	Deceiver North G.M.L. 1213	44·00	70·42	1·60	168·00	337·22	2·00
„ 1901	Do. do. 1213	124·00	266·80	2·15			
„ 1902	Brilliant G.M.L. 1115 ...	31·00	5·61	·18	46·00	14·54	
„ 1903	Do. do. 1115 ...	15·00	8·93	·59			
„ 1905	Lily G.M.L. 1494	226·50	134·02	·59	226·50	134·02	·59
„ 1897	Lily No. 2 South G.M.L. 697	25·00	19·91	·75	35·00	23·57	·67
„ 1897	Do. do. 697...	10·00	3·66	·36			
„ 1897	Deceiver G.M.L. 1115 ...	31·00	48·76	1.57	1,423·50	2,117·13	1·48
„ 1898	Do. do. 1115 ...	374·00	726·60	1·64			
„ 1899	Do. do. 1115 ...	159·00	312·94	1·93			
„ 1900	Do. do. 1115 ...	172·00	237·68	1·38			
„ 1901	Do. do. 1115 ...	94·00	112·18	1·19			
„ 1902	Do. do. 1115 ...	24·00	16·42	·68			
„ 1903	Do. do. 1115 ...	325·00	445·83	1·37			
„ 1904	Do. do. 1115 ...	197·00	208·20	1·05			
„ 1905	Do. do. 1115 ...	47·50	8·52	·11			
	Total	...	...	...	2,702·00	3,668·70	1·35

The Lily North, G.M.Ls. 1049, 1131 (abandoned).—This and the Lily North Extended, G.M.L. 1131, are situated upon the same belt of country to the northward but there is no indication of the reef being continuous.

The reef is of a white nature, being enclosed in kaolin at the surface which makes into a felstone with depth and will probably be found to be a felspar porphyry below the water level [6876-7].

Little work has been done upon this reef, but the small amount of stone crushed appears to have been of high grade and when the fact is borne in mind that the sands were not treated and that battery extraction was not high in the early days of the field, the stone raised must have been rich, since 145 tons yielded 321 ounces of fine gold, which is nearly 2¼ ounces per ton.

The Old Francis, G.M.L. 1429 (abandoned).—This area, formerly known as the Francis, is situated to the eastward of the Lily, and was worked in the early nineties by a company who had a plant upon it including an Otis ball mill.

The reef strikes north-west and dips north-east, being two feet in width and upon it a vertical shaft has been sunk to a depth of 160 feet with drives at 50 and 100 feet for a distance of 200 feet, the latter depth being the water level.

About 3 chains to the eastward is a parallel reef which has been recently worked; it dips in a south-westerly direction or towards the Francis reef, but it has not yet been followed down to the junction.

These reefs appear to be spur fissures striking off into the granodiorite from the entangled greenstone mass which passes through the Belgravia, and they are also cut into by a green felspathic dyke which has a north-easterly course [6888].

Table showing the Yield of the Old Francis Reef.

Year.	Name and Number of Lease.	Ore crushed.	Gold therefrom.	Rate per ton.
		tons.	ozs.	ozs.
1895	Francis G.M.L. 226	135·00	72·00	·53
1904	Old Francis G.M.L. 1429	28·00	8·00	·28
	Total	**163·00**	**80·00**	**·49**

The Belgravia, G.M.L. 1056 (abandoned).—This old mine is situated to the eastward of the Francis, close to the south-west corner of the town.

The reef has a north-west and a south-easterly course with an underlay to the north-east, the country being grano-diorite at the north but at the south the fissure extends into a branch-like portion of the amphibolites which has here been enclosed in the former rock.

The only information available is that one shaft has been sunk on the reef for a distance of 100 feet.

Table showing the Yield of the Belgravia Reef.

Year.	Name and Number of Lease.	Ore crushed.	Gold therefrom.	Rate per ton.
		tons.	ozs.	ozs.
1896	Belgravia G.M.L. 1056–1057	102·00	69·69	·68
1897	Do. Central G.M.L. 789	90·00	60·13	·67
1898	Do. do 789	73·50	38·14	·52
1899	Do. do. 789	16·00	105·76	6·61
	Total	**281·50**	**273·72**	**·97**

Research, G.M.L. 1332, and *Royal North, G.M.L.* 1379 (abandoned).—These are two old leases covering the same ground, situated a little south of the Belgravia. The reef strikes north-east and dips north-west; little work has been done on it.

Table showing the Yield of the Research Reef.

Year.	Name and Number of Lease.	Ore crushed.	Gold therefrom.	Rate per ton.
		tons.	ozs.	ozs.
1902	Research G.M.L. 1332	24·00	14·92	·62
1904	Royal North G.M.L. 1379	20·00	5·65	·28
	Total	**44·00**	**20·57**	**·47**

Real McKay, G.M.L 234 (abandoned).—A little to the westward of the town, at the junction of the telegraph line with the Cuddingwarra Road, are some old workings upon a well-defined reef from 1 foot 6 inches to 3 feet in width, which has a strike to the north-west, with a dip of 65 degrees to the south-west.

The workings consist of a number of shallow shafts and open cuts.

A spur reef with a north and south course strikes off from this reef following a greenstone dyke, upon which a little work has been done [**3808, 3809**].

There is only a record of one crushing from this mine, in 1901, when 40 tons were crushed yielding 13.77 ounces of fine gold.

Campania, G.M.L. 219 (abandoned).—This reef is the north western extension of the last-mentioned, and is about 2 feet 6 inche in width. There are a number of shallow shafts upon it, and al a main vertical one 90 feet in depth, with a drive 35 feet in length at the 60 feet level.

There is only one crushing from this area upon record, which was taken out in the year 1895, it being 104 tons which yielded 41 ounces of gold.

Anglo-Saxon, G.M.L. 220 (abandoned).—This is situated upon the same line of fissure, but the reef, which has the same course and underlay, cannot be traced between the two.

Several shallow shafts were sunk, the deepest being 85 feet.

At the time of Mr. Goczel's (late Field Geologist) visit in 1894, he states that 50 tons of stone crushed yielded 137½ ounces of gold, and that 80 tons more were at grass awaiting treatment.

Maori, G.M.L. 1418 (abandoned).—This line, which is practically parallel with the last-mentioned at a distance of 25 chains to the north-eastward, strikes off from the north-west corner of the town. It has a dip of about 67 degrees to the south-west, and is about 5 feet in width, being worked from a number of underlay shafts and one vertical one to a depth of 150 feet, the water level being 125 feet.

Of this mine Mr. Goczel (late Field Geologist) says, in 1894, that 250 tons were crushed yielding over 500 ounces of gold.

This reef has since been worked under the name of the New England, and later, the Maori again.

Table showing the Yield of the Maori Reef.

Year.	Name and Number of Lease.	Ore crushed.	Gold therefrom.	Rate per ton.
		tons.	ozs.	ozs.
1895	Cue G.M.L. 229	592·00	473·00	·80
1897	New England G.M.L. 1107	7·00	8·23	1·03
1899	Maori G.M.L. 1157	18·00	4·91	·27
1900	Do. do.	20·00	7·61	·38
1905	Do. do.	11·00	9·22	·83
	Total	**648·00**	**502·97**	**·77**

Welcome, G.M.L. 1308 (abandoned).—This reef lies to the orth-westward of the last-mentioned, it being on the same line of ssure, but the reef, which has the same strike and dip, is not ntinuous.

A few shallow shafts have been sunk upon the outcrop and one tical shaft to the dip, from which 130 tons of stone were raised treated in 1902, which yielded 46.53 ounces of fine gold.

Young Colonial, G.M.L. 1297 (abandoned).—This is a reef with a strike nearly north and south, dipping at an angle of 65 degrees to the westward lying about 10 chains to the eastward of the Maori.

A considerable amount of shallow work has been done by the various holders, and a vertical shaft sunk to a depth of 120 feet, which is the water level.

This reef is accompanied by a greenstone dyke upon the hanging wall.

Table showing the Yield of the Young Colonial Reef.

Year.	Name and Number of Lease.	Ore crushed.	Gold therefrom.	Rate per ton.
		tons.	ozs.	ozs.
1898	Young Colonial G.M.L. 1124	154·50	245·84	1·59
1899	Maude G.M.L. 1144	75 00	97·94	1·30
1900	Do. do. 1144	77·00	63·95	·83
1902	Young Colonial G.M.L. 1279	43·00	18·79	·43
	Total	**349·50**	**426·52**	**1·22**

Salisbury, G.M.L. 1374 (Plate IV.).—This mine, which is situated about 1½ miles due north of Cue has been continuously worked for a number of years, the first crushing having been taken out prior to 1897. In 1898 and 1899 it became the property of the company called the Agamemnon, Ltd., who worked it in conjunction with two other mines bulking the results, therefore it is impossible to arrive at an estimate of the value and quantity of the stone raised.

During the following year it fell into the hands of a party of working miners who raised all the payable stone visible above the water level, and rendered all the upper level quite unsafe ; it has now fortunately passed into the hands of a company who have erected a thoroughly up-to-date plant, and are pushing on with the developments by sinking the main vertical shaft, and driving below the water level.

The reef is a well defined body at the surface, having a north-easterly strike with a dip to the south-westward of from 62 to 72 degrees, it presents a bold outcrop for a distance of 17 chains, and can be traced still farther southward by strewn quartz, but at the north end, just beyond the workings, it suddenly plunges beneath an alluvial flat to reappear no more.

Like so many reefs in this district it is associated with a diorite dyke, which, although carrying no value in the oxidised zone, is called formation. This dyke mass is often of considerable width, whilst in places, as above the 150 feet level it pinches, and the quartz veins which here lie upon either side of it are brought almost into contact.

The richest stone occurs in a well defined shoot which has a northerly dip, this, from the surface down to the 50 foot level appears to have been confined to a quartz body upon the footwall of the dyke, but below the 150 foot level this ore body appears to die out, whilst the hanging wall body increases in size and value.

The quartz is of a brownish colour in the upper levels but is blue and contains a considerable quantity of pyrites below the water. The whole formation is enclosed by well-defined striated walls, the shoot dipping at an angle of 63 degrees to the northward upon the lode plane, being 170 feet in width both at the surface and the 200 feet level. The formation consists of chloritic schist in the oxidised zone but below that it is a solid fine grained diorite in a grano-diorite country.

The water in this mine is salt, and at the present time is making at the rate of 12,000 gallons per diem.

The main vertical shaft has been sunk to a depth of 250 feet, passing through the reef at the 200 feet level. This shaft is connected with a reef at the 50 feet level by a crosscut 70 feet in length from which point a drive has been carried north 140 feet and south 120 feet, at the 100 feet below the surface a crosscut has been driven 43 feet east to the No. 2 level, which is in 85 feet south and 160 feet north, at a depth of 150 feet a crosscut 12½ feet east connects the shaft with the No. 3 level, where the reef has been driven on for a length of 45 feet north and 120 feet south. At the present time only portions of these levels are accessible and no record exists of the general character of the lode except that it varied from 2 to 6 feet in width.

At a point just below the intersection of the reef by the shaft it has been driven upon for a distance of 100 feet south and 340 feet north. In the south drive the reef carries no values since the shaft cut it at the southern extremity of the shoot. In the north drive the shoot is 170 feet in length whilst the formation between the walls as proved by several crosscuts varies from 12 to 39 feet; this carries no stone north of the shoot.

The reef has now been crosscut west at the 250 feet level and driven upon in a northerly direction for a considerable distance without encountering the continuation of the shoot which later on was found to die out just below the 200 feet level. This level has now been extended to the southward where a new make of stone has been met with below it by winzing.

Table showing the Yield of the Salisbury Reef.

Year.	Name and Number of Lease.	Ore crushed.	Gold therefrom.	Rate per ton.
		tons.	ozs.	ozs.
Prior to 1897	Salisbury G.M.L. 1046	138·00	158·38	1·22
1897 ...	Do. do.	459·50	798·21	1·74
1898 ...	(Under Agamemnon, late) ...	...	...	...
1899 ...	Do. do. ...	..	...	...
1900 ...	Do. do. ...	172·00	86·82	1·73
1901 ...	Do. do. ...	290·00	81·41	·28
1902 ...	Do. do. ...	1,403·00	936·17	·66
1903 ...	Do. do. ...	22·00	9·97	·45
1903 ...	Salisbury G.M.L. 1374	104·00	55·30	·53
1904 ...	Do. do.	475·00	269·34	·56
1905 ...	Do. do.	1,200·00	1,037·31	·86
1906 ...	Do. do.	3,079·00	2,044·36	·66
	Total	7,342·50	5,477·27	·74

It is pleasing to note that the 1,200 tons last crushed, which was stoped from between the 150 and 200 feet level, yielded a better result than any of the crushings since the outcrop stone was treated.

Lady Florence, late Lady Mary, G.M.L. 1265. (Plate V.)—This mine was worked upon a parallel line of reef about seven chains due west of the Cue One (q.v.).

It is a double lode, one sheet of quartz lying upon either wall of a weathered basic dyke having a total width between the walls of 10 feet, dipping at an angle of 39 degrees to the westward.

A main underlay shaft has been sunk upon the formation to a depth of 216 feet measured upon the incline, or 135 feet vertical, this being the water level. At this level the lode has been driven on for a distance of 200 feet north, the first 100 feet from the shaft being stoped up to the No. 1 level, whilst to the south the level has been driven 100 feet, 80 feet of which has been stoped up.

Below this level from the bottom of the main underlay a winze has been carried down for a depth of 80 feet, and three other small winzes have also been sunk from it.

The No. 1 level, which is 145 feet upon the incline and 70 feet vertically below the surface, has been driven 225 feet north, the stone from above being mostly stoped, whilst to the southward it was extended 130 feet, 70 feet of which has been stoped.

The continuation of this lode to the dip was cut in the new main shaft at a vertical depth of 230 feet which proves that the body is continuous and of an uniform dip, unfortunately at the point of intersection it was of no value. This mine has been closed down for several years but is held as a block claim to the Cue No. 1, the new main shaft of which is upon this lease.

Upon the southern end of this lode, which was formerly called the Lady Mary No. 1 South, a shaft has been sunk to a depth of 94 feet upon the underlay in which the formation between the walls measured 27 feet but of this only 18 inches was quartz.

Table showing the Yield of the Lady Mary Reef.

Year.	Name and Number of Lease.	Ore crushed.	Gold therefrom.	Rate per ton.	Total.		Average rate per ton.
					Ore crushed.	Gold therefrom.	
		tons.	ozs.	ozs.	tons.	ozs.	ozs.
1896	Lady Mary Amalgamated G.M.L. 674 and 60*	2,099·00	2,095·53	·99			
1897	Lady Mary Amalgamated G.M.L. 674*	1,014·00	853·42	·84			
1898	Do do 674*	...	220 57	...	3,151·00	3,189·25	1·01
1900	Do do 1222	38 00	19·73	·52	38 00	19·73	·52
1896	Lady Mary No. 1 South G.M.L. 157	147·00	238·75	1·62			
1897	Do do 157	121·00	197·56	1·63			
1898	Do do 157	30·00	44·56	1·48			
1899	Do do 157	121·00	317·18	2·62			
1900	Do do 157	16·50	16 01	·94	435·50	814·06	1·87
	Total	...	...	...	**3,624·50**	**4,023·04**	**1·11**

*Includes the Rising Sun, G.M.L. 60.

Cue No. 1, *G.M.L.* 203. (Plate V.)—This was one of the arliest gold-bearing reefs discovered in this district, it having been ken up by Messrs. Pead and Edwards in the early part of the ear 1892; it subsequently passed into the hands of the Cue conlidated Gold Mine, Ltd., by whom it was worked in conjunction h several other leases until the year 1900, when at the winding up of the company it was purchased by Messrs. Chesson and Hayden, the present owners.

There is a plant consisting of 20 head of stamps, 8 leaching and 3 storage vats, two winding engines with the necessary boiler power and pumps; this battery is at present being used as a public crushing plant whilst developments are being carried on upon the mine.

The reef has a general strike of nearly north and south with an underlay of 37 degrees to the westward it had a continuous outcrop of 300 feet south from the northern boundary of the lease beyond which point it is lost, a blow of quartz however occurs just outside the south boundary upon the same line which is in all probability within the same fissure.

The country rock is grano-diorite whilst the fissure contains both a quartz reef and a diorite dyke, the latter being weathered into a magnesian clay near the surface where it forms the hanging wall of the lode and is called formation, although of no value.

This same dyke is met with at the bottom of the new vertical shaft, which was examined by Mr. Talbot, Field Assistant, in June, 1906, who reports:—"At the shaft bottom the country rock is granite but a few feet from it the crosscut enters what is called the 'formation' and continues to pass through it for a distance of 20 feet when the granite is again seen. This is not the true thickness of the formation as at this point it is very flat. The so-called formation appears to me to be simply a diorite dyke that has been intruded along the same line of fracture as the quartz reef."

The reef fissure is one of the radiating series situated near the contact zone of the grano-diorites with the amphibolites probably resulting from the contraction of the former upon cooling. This fissure will probably prove to be of very considerable vertical extent since it is traversed by an intrusive dyke but it would be premature to express an opinion with regard to the behaviour of the included quartz body or its zones of value until more work has been done at the 530 foot level, particularly as the lower workings in the old mine are not open to inspection.

The mine being inaccessible owing to the water having been allowed to accumulate, the old workings below the No. 2 level could not be inspected whilst in those above this level nothing could be seen but stoped out ground, most of which was unsafe, the plan of the workings as supplied by the old company has been taken as a basis for the description of the work done, whilst the dotted portions have been added from information supplied by the present owners who have had no survey made.

A considerable amount of development has been done upon this mine, which was originally worked to the No. 2 level by an underlay shaft, then a vertical shaft was sunk to a depth of 270 feet

LIBRARY OF THE UNIVERSITY OF CALIFORNIA

intersecting the reef at about 162 feet from the surface, the Nos. 2 and 4 levels were connected by a winze, being the continuation of the main underlay shaft and another winze was sunk below the No. 4 level for a distance of 104 feet upon the dip of the reef.

The No. 1 level, which is at a vertical depth of 87 feet from the surface, is connected with the vertical shaft by a crosscut 87 feet in length from which it has been driven 250 feet north from 170 feet of which the reef has been stoped out, beyond which it was broken and valueless, whilst south it was continued for a distance of 230 feet in good stone all the way, the stoping being carried on for a distance of 70 feet beyond the end of the level.

The No. 2 level is 129 feet from the surface and is connected with the shaft by a crosscut 41 feet in length; it has been driven for a distance of 250 feet north, the last 50 feet being in valueless country whilst the balance has been stoped. This level has been extended south for a distance of 500 feet from the whole of which length the stone has been stoped.

The No. 3 level is at a vertical depth of 178 feet from the surface and is connected with the main shaft by a crosscut 10 feet in length; it has been driven for a distance of 270 feet north but in this no stone of sufficient value to pay for crushing was met with, whilst in the south drive, which is 500 feet in length, the reef proved to be payable throughout.

From this level a crosscut has been driven west for a distance of 350 feet beneath the Lady Mary Reef, if this had been continued another 70 feet the winze in that mine would have been cut.

The No. 4 level is connected with the main shaft by a crosscut 132 feet in length, and has been driven 130 feet north in barren ground whilst in the south level, which is 300 feet in length, the first 120 feet proved to be barren, the next 130 feet of sufficient value to stope up to the No. 3, and the last 50 feet barren.

Below this level only a small quantity of ore has been stoped. The stoped portions as seen upon the section create the impression that a fairly well-defined shoot of payable stone having a southerly dip has been worked out; if this is the case the shoot in this mine behaves in an entirely different manner to the other lodes upon this field, in which the shoots of the reef having a northerly course invariably dip in that direction.

It is quite impossible to form a decided opinion with regard to this reef, as the workings are inaccessible, but it is quite possible that instead of one shoot dipping to the southward there may be two short ones dipping to the northward and this theory is in a measure borne out by the fact that the old company worked the northern portion down to the No. 2 level, where the lode lost its values, whilst later on the present owners found an equal sized patch

of payable stone further to the southward in the Nos. 2, 3
levels, below which it also lost its values; this latter may ha
upon the other side of the formation, as in the Salisbury.

It is clear that a continuous shoot does not exist in thi
but the rich stone may occur (as it often does in other c
as a series of lenticular masses of considerable extent, wh
though not connected follow a general direction, and if this
be the case in this instance it is quite possible that more c
may be met with on the dip of the lode.

A new main vertical shaft has been sunk at a point 7
west of the main underlay shaft, this cut the Lady Mary re
depth of 230 feet but it was broken and of little value, it w
carried down to a depth of 549 feet with Government ass
at which depth the Cue No. 1 reef was cut.

After leaving a 20 foot sump a crosscut was driven
east, the reef here consists of small quartz veins in a crushe
rock. Samples taken at the crosscut yielded no gold, whi
taken 98 feet from it gave gold at the rate of 7dwts. 10 gr
the ton, whilst one at 90 feet only yielded a trace.

This is so far satisfactory, as proving that the reef still
gold at this level, and therefore the Government has contin
subsidy in order to prove whether any payable stone exists
depth.

It is quite impossible to arrive at a correct estimate
quantity of stone crushed from this mine owing to the fa
prior to 1898 it was worked in conjunction with the Prince
whilst during 1898 and 1899 the returns included the cr
from the Cue No. 1, Princess Ada, Rising Sun, and Light of

Table showing the Yield of the Cue No. 1. Reef.

Year.	Name and Number of Lease.			Ore crushed.	Gold therefrom.
				tons.	ozs.
Prior to 1897	*Cue No. 1 G.M.L. 202		...	3,815·00	3,984·55
1897	* Do.	do.	...	6,688·00	4,496·62
1898	† Do.	do.	...	6,652·00	4,130·25
1899	‡ Do.	do.	...	650·00	1,387·16
1900	Do.	do.	...	434·50	487·45
1901	Do.	do.	...	283·00	117·44
1902	Do.	do.	...	4,203·00	4,755·82
1903	Do.	do.	...	1,812·50	3,689·80
1904	Do.	do.	...	541·50	2,287·07
1905	Do.	do.	...	703·00	1,092·46
1906	Do.	do.	...	47·00	67·37
		Total ...	...	25,829·50	26,495·99

* Including Princess Ada. † Including Princess Ada, Lady Mary, Rising
and Light of Asia. ‡ Including Lady Mary and Rising Sun.

Rising Sun, G.M.L. 1248. (Plate V.).—This old mine is upon what is apparently the northern extension of the Cue No. 1 fissure, but the quartz body does not appear to be continuous. It was discovered as far back as 1892 by Mr. Prendergast, but later on passed into the hands of the Lady May Amalgamated, then the Cue Consolidated, and later still into those of the present owners, Messrs. Chesson and Hayden.

It was originally equipped with a crushing and winding plant, but these have long since been removed and the workings allowed to fall in as it is now only held for area purposes.

The reef outcropped for a length of 480 feet, the northern 300 feet of which has been stoped to the surface, a particularly rich portion being met with at the junction of a spur reef which runs away to the eastward.

The plan of this old mine shows that the lode was followed down upon the underlay for a distance of 280 feet, levels being set off at the 200 and 140 feet, the former of these is 170 feet in length and the latter 270 feet, all the stopes being apparently between this level and the surface.

Between the south end of the outcrop of this reef and that worked in the Cue No.1 there is a break of about 120 feet where no stone shows at the surface, this was also driven into in the Nos. 1 and 2 from the latter mine, where formation with only a little stone was met with.

Prior to the year 1900, this mine was worked by a company called the Lady Mary Amalgamated, the returns being bulked with those from that mine.

Table showing the Yield of the Rising Sun Reef.

Year.	Name and Number of Lease.	Ore crushed.	Gold therefrom.	Rate per ton.
		tons.	ozs.	ozs.
1900	Rising Sun G.M.L. 1248	80 00	42·40	·53
1901	Do. do.	871·00	660·91	·75
02	Do. do.	247·00	135·31	·54
	Total	1,198·00	838·62	·70

Rising Sun North, G.M.Ls. 1262, 1500.—Immediately to the thward of the Lady Mary and the Rising Sun are two leases ich both bear the same name, G.M.L. 1262 being to the north of the latter and was worked in the year 1901, when 56 tons of stone raised yielded 36.03ozs. of fine gold, whilst G.M.L. 1500 was worked in the year 1905 upon a block north of the Lady Mary, which yielded 15 tons of stone which returned 1.08ozs. of gold.

Success, late Caledonian Hill, G.M.L. 1504.—This lease is situated at the north-east corner of the Cue township by the railway line at the base of the Cue Hill.

It is at the south end of the large dryblowing patch, and from the surface of this lease a considerable quantity of gold is said to have been obtained.

It was originally taken up by Dr. Monteith (as the Caledonian Hill Sluicing Co.) with the object of sluicing the surface, but since the fall of the surface was into the main street of the town, this project was abandoned and the reefs worked instead.

In the year 1901 the property was abandoned, after which the town council used the main shaft as a well, but since a new water supply has been obtained this lease has again been taken up as the Success.

The main reef upon this lease is large and well defined, running upon a north-easterly course with a dip of from 70 to 75 degrees to the westward. The quartz is very ferruginous, and in places consists very largely of oxide of iron ; however, the gold contents are as a rule very low, with here and there small but rich patches.

The country rock enclosing the reef is amphibolite schist, but the grano-diorite being met with from 250 to 300 feet to the westward, therefore this reef may be said to be within the contact zone. Between the reef and the granite there is a porphyritic dyke which dips at a low angle to the eastward, passing through the reef but causing no displacement [**6892-3**].

The whole of the western portion of the lease is strewn with quartz, which has been worked over several times by the dryblowers, but in spite of the fact that numerous reefs outcrop, the gold can in no case be traced to them, it is therefore quite probable that the superficial deposit was derived from southerly extension of one of the flat reefs which exist to the northward ; the scattered fragments of quartz and gold being all that remain of it.

A number of shafts have been sunk along the reef outcrop t various depths, and from these small parcels of stone have bee crushed, but since only 100 tons of stone were treated during th five years that the property was worked by the Company, it must b assumed that payable stone only occurred in very limited quantitie

A main shaft was sunk to a depth of 190ft., but since a ver heavy water supply was cut, a crosscut was driven above it in easterly direction for a distance of 60 feet to the reef at the 140ft. level. From this crosscut the reef has been driven on for a distance of 140ft. north and 10ft. south, connection being made with the old No. 2 shaft, which is 30ft. vertical and 130ft. on the underlay, at a distance of 105ft. from the crosscut.

The drive has been extended 35 feet north of the No. 2 shaft, the object of the prospectors being to carry it on another 120 feet to a point beneath an old 90ft. shaft (No. 1) from which some rich stone is said to have been taken.

The stone in this level has been consistently of no value, with the exception of a small patch 69 feet north of the crosscut, where a small rich bunch was cut, from which 24½ tons of stone were raised and crushed, which yielded 22.92 ounces of fine gold.

Most of the development work done by the original company is upon the south end of the reef, also the main shaft is located in that quarter, this apparently indicates that the then manager was of the opinion that the greatest values would be met with there. This is supported by one of the present owners who worked in the mine at the time, who states that some of the best crushings came from the south end.

Table showing the Yield of the Caledonian Hill Reef.

Year.	Name and Number of Lease.	Ore crushed.	Gold therefrom.	Rate per ton.
		tons.	ozs.	ozs.
1897	Caledonian Hill G.M.L. 1068	...	36·58	
1898	Do. do. do.	5·00	8·71	1·74
1899	Do. do. do.	42·00	36·27	·46
1900	Do. do. do.	18·00	5·47	·30
1901	Do. do. do.	35·00	14·13	·40
1906	Success G.M.L. 1504	24·50	22·92	·93
	Total	**124·50**	**124·08**	**1·00**

The West Australian, G.M.L. 1172.—This lease, which was ormerly known as the Princess Ada South, is situated between the rincess Ada and the Cue No. 1, and upon it a considerable quantity work has been done upon a north-west reef which underlays to eastward.

A vertical shaft was sunk to a depth of 220 feet with the object of cutting the Princess lode, but this was unsuccessful.

There are only records of two crushings from this mine, one being taken out in 1897, under the name of the Princess Ada South, G.M.L. 1059, and the other under that of the West Australian, G.M.L. 1172, in 1901, which totalled 164 tons of stone yielding 18.12 ounces of fine gold.

Princess Ada, G.M.L. 1433, 1481 (Plate VI.).—This property is situated a little northward of the Cue township boundary, and from its surface in the early days of this field a very considerable quantity of gold has been won by the dryblowers.

The reef itself averages about 2 feet 6 inches in thickness, having a well defined outcrop running a little north of east for a length of 17 chains, with a dip of about 33 degrees to the southward.

It was first worked by the prospectors, then by Messrs. Bewick, Moreing, and Co., in conjunction with the Cue No. 1 for two years, during which time the shoot of stone was stoped up from the water level (150 feet) to the 60 feet level. Upon their abandoning it the original prospectors again took it up and stoped the balance of the stone to the surface, they also put down a main vertical shaft to the water level, and followed the reef down for a further distance of 80 feet on the underlay.

A new vertical main shaft has now been sunk southward of the old workings to a depth of 250 feet, from which a crosscut was driven north for a distance of 200 feet to the winze in the old workings. The country passed through in this shaft was foliated granite to the water level, below which the massive grano-diorite was encountered, the reef being accompanied on either side by a formation consisting of a weathered schistose rock containing a considerable quantity of mica. In this shaft a good supply of fresh water was cut, which yielded 15,000 gallons in the 24 hours. Between the main shaft and the old workings there is a cross reef which strikes in a north-westerly direction, dipping to the north-east, upon which a considerable amount of shallow work has been recently carried on with very good results, but this reef has not yet been traced down to its junction with the Ada reef.

No returns appear from this mine until it was worked with the Cue No. 1, and then it is included in the yield from that mine, therefore it is impossible to arrive at a correct estimate of its production.

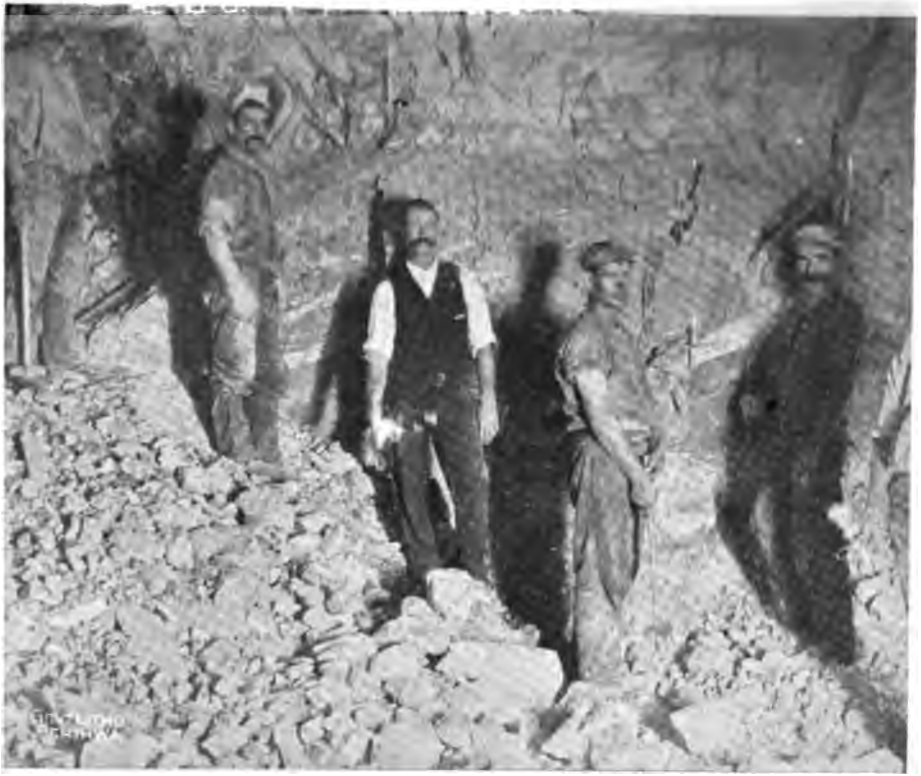


Photo., H. P. Woodward. The Reef in the Volunteer South Extended.

Table showing the Yield of the Princess Ada Reef.

Year.	Name and Number of Lease.	Ore crushed.	Gold therefrom.	Rate per ton.
		tons.	ozs.	ozs.
1899	Princess leases G.M.L. 1150 and 1178...	446·00	407·46	·90
1900	Do. do. 1150 and 1178...	490·00	542·55	1·10
1901	Do. do. 1150 and 1178...	306·00	190·19	·62
1902	Do. do. 1150 and 1178...	10·00	4·24	·42
1903	Do. do. 1150 and 1178...	487·00	200·36	·41
1904	Do. do. 1150 and 1178...	51·00	10·16	·19
1905	Princess Ada G.M.L. 1433	225·00	113·66	·50
1906	Do. do. 1433	1,552·00	563·67	·36
1906	Old Princess Ada G.M.L. 1488 ...	889·00	428·18	·48
	Total	**4,456·00**	**2,460·47**	**·55**

The tailings from the early crushings were later on purchased and treated with cyanide when they gave an extract of 3½dwts. per ton of sands.

The Volunteer Group.—This group of leases is upon what is known as "The Patch," which is a large dryblowing area from which a very considerable quantity of gold was won in the early days of this field, situated to the northward of the town, and between it and Table Top Hill.

The reefs of this group occur as more or less horizontal sheets, some of which do not outcrop but were discovered in sinking, in some instances one overlaying another, so far, however, no prospecting has been carried on in the solid country which comes in at a depth of 120 feet.

The country above this level is for the most part kaolinised granite, which is so soft that it can be bored with an auger, but in some places portions of the rock still remain solid and unaltered in which the reefs have not generally proved to be rich. [3810].

The footwalls, or floors, of the quartz bodies present a rolling character, the angle of inclination of which rarely reaches, and never exceeds, 17 degrees ; on the other hand, however, the hanging wall or roof varies very considerably from it, being most irregular, rising in places until the reef assumes a thickness of as much as 13 feet (see Photograph Nos. 9 and 10), then suddenly closing down and reducing the size of the vein to 18 inches or 2 feet.

Before this erratic character was understood a shaft was sunk in order to test a large reef being worked in an adjoining lease, but striking a small low value vein it was abandoned. Later on, however, when the workings were extended from another point in this direction, it was discovered that the shaft had been sunk through a pinched portion of the reef only a few feet from a fine body of stone.

Although not of high grade, the cheapness with which these arge bodies of stone can be worked has rendered them very pro-table for some time past whilst the total production, which amounts 21,435 ounces of fine gold, has added very materially to the osperity of the town.

Table showing the Yield of the Volunteer Group of Reefs.

Year.	Name and Number of Lease.	Ore crushed.	Gold therefrom.	Rate per ton.	Total. Ore crushed.	Total. Gold therefrom.	Average Rate per ton.
		tons.	ozs.	ozs.	tons.	ozs.	ozs.
1900	Comforter G.M.L. 1234	29·00	12·00	·41			
1902	Do do	64·00	29·19	·45	93·03	41·19	·44
1896	Conscript G.M.L. 1067	12·00	9·96	·83			
1897	Golden Garter G.M.L. 1111	72·00	44·71	·62			
1898	Do do	412·00	171·86	·41			
1899	Do do	136·00	8·93	·06	620·00	225·50	·36
1903	New Volunteer Extended G.M.L. 1259	229·00	154·19	·67	229·00	154·19	·67
1896	Volunteer G.M.L. 1070	108·00	143·00	1·32			
1897	Do do	54·00	32·93	·60			
1898	Do do	37·50	36·85	·98	199·50	212·78	1·06
1898	New Volunteer G.M.L. 1135	463·00	191·92	·41			
1899	Do do	302·00	262·55	·86			
1900	Do do	474·00	502·70	1·06			
1901	Do do	698·00	772·59	1·10			
1902	Do do	1,434·00	1,302·23	·90			
1903	Do do	347·00	132·75	·38			
1904	Do do	512·00	255·12	·49			
1905	Do do	200·00	225·00	1·12			
1906	Do do	129·00	39·56	·30	4,559·00	3,684·52	·80

1903	Volunteer North G.M.L. 1350	40·00	10·06	·25			
1904	Do do	65·00	13·70	·30			
1905	Do do	16·50	5·97	·36	121·50	29·73	·24
1902	Volunteer Deeps G.M.L. 1323	20·00	2·01	·10	20·00	2·01	·10
1899	New Venture G.M.L. 1161	24·00	4·73	·19	24·00	4·73	·19
1899	Struggle G.M.L. 1153	35·00	5·93	·17			
1900	Do	90·00	25·36	·28	125·00	31·29	·25
1896	South Volunteer G.M.L. 1044	50·00	27·15	·54			
1897	Do do	76·00	45·78	·60			
1901	Do do	61·00	33·41	·54			
1902	Do do	415·00	198·41	·47			
1903	Do do	3,634·00	1,951·74	·53			
1904	Do do	1,134·00	444·57	·39			
1905	Do do	235·00	105·78	·45	5,479 00	2,733·85	·49
1899	Volunteer South Extended G.M.L. 1145	430·00	297·84	·69			
1900	Do do	1,105·00	910·83	·82			
1901	Do do	1,465·00	1,544·19	1·05			
1902	Do do	3,135·50	2,192·61	·67			
1903	Do do	5,246·00	2,669·50	·50			
1904	Do do	3,062·00	1,111·58	·36			
1905	Do do	1,840·50	769·75	·41			
1906	Do do	3,784·00	1,332·80	·35	20,068·00	10,829·10	·54
1896	Twilight G.M.L. 774	110·00	124·90	1·13			
1897	Do do	138·00	175·47	1·27			
1898	Do do	227·00	270·32	1·14			
1899	Do do	423·00	419·74	·99			
1900	Do do	388·00	305·78	·78			
1901	Do do	342·00	198·85	·58			

Table showing the Yield of the Volunteer Group of Reefs—continued.

Year.	Name and Number of Lease.	Ore crushed.	Gold therefrom.	Rate per ton.	Total.		Average Rate per ton.
					Ore crushed.	Gold therefrom.	
		tons.	ozs.	ozs.	tons.	ozs.	ozs.
1902	Twilight G.M.L. 774	45·00	15·96	·35			
1903	Do do	568·00	203·14	·34			
1904	Do do	116·00	93·09	·79	2,357·50	1,807·25	·79
1904	Twilight South G.M.L. 1090	252·00	180·56	·71			
1905	Do do	89·00	24 79	·27	341·00	205·35	·60
1902	Starlight G.M.L. 1325	105·00	84·79	·80			
1903	Do do	548·00	573·63	1·04			
1904	Do do	358·00	390·80	1·09			
1905	Do do	262·00	285·14	1·08			
1906	Do do	233·50	139 04	·59	1,506·50	1,478·40	·97
	Total	...	...	...	**35,743·00**	**21,435·09**	**·60**

PHOTO 10.

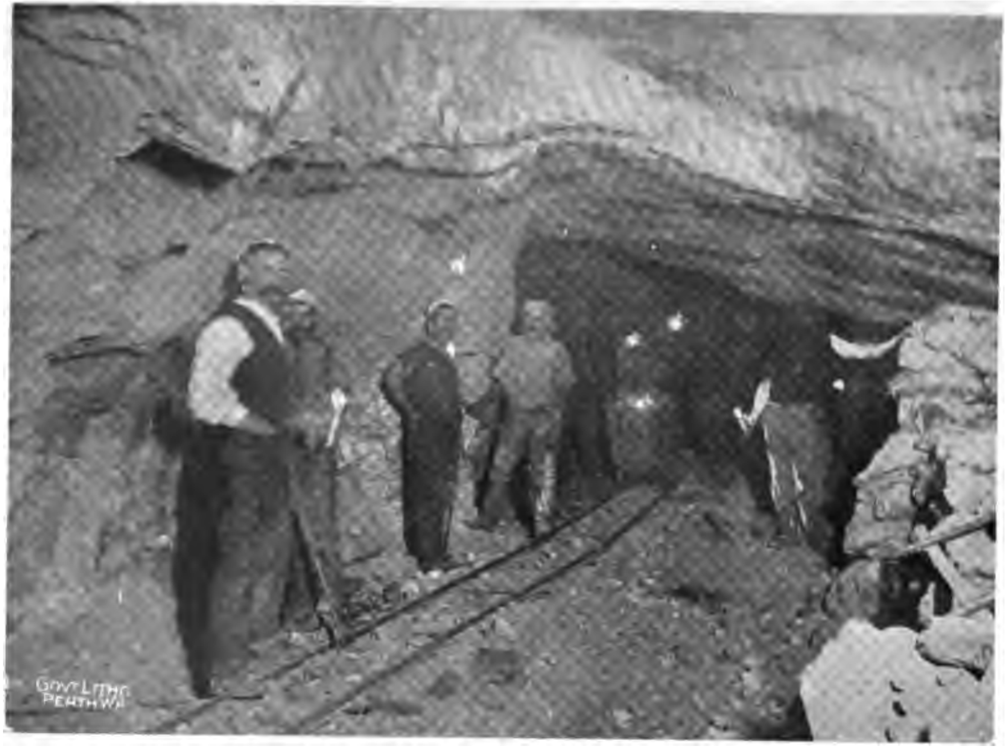


Photo., H. P. Woodward.

The Reef in the Volunteer South Extended

The Countess, G.M.L. 1066.—This lease is situated upon the northern side of Table Top Hill, about one mile north of Cue.

The country is kaolinised grano-diorite down to the water level, below which it is extremely hard and contains segregations of finer-grained grano-diorite [6883-6].

There are two or three small quartz reefs upon this lease which strike in a north-westerly direction and underlay southerly at a low angle, most work having been done upon the northernmost of these.

Some few years ago an attempt was made, with Government assistance, to cut the dip of the Arcadia reef, which is a north-west reef in the adjoining property to the north. It is from 4 to 7 feet in thickness, and has an outcrop of about 20 chains, and yielded a considerable quantity of rich stone.

The shaft had been sunk to a depth of 290 feet by a local company when they obtained a subsidy to help them to carry it on for another 100 feet; however, for some reason it was abandoned when a depth of 316 feet had been reached, the only indication of a formation was cut at a depth of 260 feet, but this was of little value.

The Countess Extended, G.M.L. 1386.—This lease lies between the last-mentioned and the Table Top Hill, and upon it a number of flat reefs of a similar character in every way to the Volunteer group have been worked.

Table showing the Yield of the Countess Reef.

Year.	Name and Number of Lease.	Ore crushed.	Gold therefrom.	Rate per ton
		tons.	ozs.	ozs.
1898	Countess G.M.L. 1066	157·50	204·53	1·29
1899	Do. do. 1066	250·50	151·60	·60
1900	Do. do. 1212	10·00	7·76	·77
1901	Do. do. 1212 and 1230 ...	61·00	49·17	·80
1902	Do. do. 1212 and 1230 ...	103·00	30·51	·29
1904	Heart of Oak G.M.L. 1427	129·00	73·11	·56
1904	Countess Extended G.M.L. 1386 ...	550·00	186·79	·34
1905	Do. do. do. 1386 ...	1,148·00	685·79	·56
1906	Do. do. do. 1386 ...	728·00	421·95	·58
	Total	**3,137·00**	**1,811·21**	**·57**

Arcadia Reef.—This reef, which strikes in a north-westerly direction and dips at a low angle to the southward, lies to the northward of the Countess, and has been opened up from the railway line for a distance of 40 chains.

The lode varies considerably in size, being in places as much as feet across, and upon it a considerable quantity of work has been done, mostly of a shallow character, the greatest depth worked upon the main shoot being 150 feet upon the underlay.

This shoot was prospected for by the main vertical shaft i the Countess, but since the shaft was at least 5 chains to the south eastward of where it might have been expected it was not cut.

It has been worked since the early days of the field up to 1905 the reef line being pegged and re-pegged no fewer than eight times

Table showing the yield of the Arcadia Reef.

Year.	Name and Number of Lease.	Ore crushed.	Gold therefrom.	Rate per ton.	Total. Ore crushed.	Total. Gold therefrom.	Average. Rate per ton.
		tons.	ozs.	ozs.	tons.	ozs.	ozs.
1896	Arcadia G.M.L. 640	565·00	626·30	1·10			
1897	Do	691·00	371·29	·54			
1898	Do	351·50	285·03	·81			
1899	Do	601·00	242·78	·40			
1900	Do	65·00	31·18	·48			
1901	Do	122·00	45·47	·37	2,395·50	1,602·05	·67
1902	New Arcadia G.M.L. 1311	197·00	65·37	·33			
1903	Do	190·50	207·61	1·09			
1904	Do	204·50	91·62	·44	591·00	364·60	·61
1896	Ashbourne G.M.L. 750	501·00	440·52	·87			
1897	Do	168·00	50·91	·30	669·00	491·43	·73
1900	Arcadia North G.M.L. 1179	17·50	2·26	·13			
1901	Do 1247	6·00	1·14	·19	23·50	3·40	·14
1903	Bedford G.M.L. 1366	10·00	303·63	30·36	10·00	303·63	30·36
1905	New Arcadia North G.M.L. 1355	100·00	34·94	·34	100·00	34·94	·34
1905	New Arcadia North Extended G.M.L. 1453	58·50	33·81	·57	58·50	33·81	·57
	Total	...	...	...	3,847·50	2,833·86	·73

PHOTO. 11.

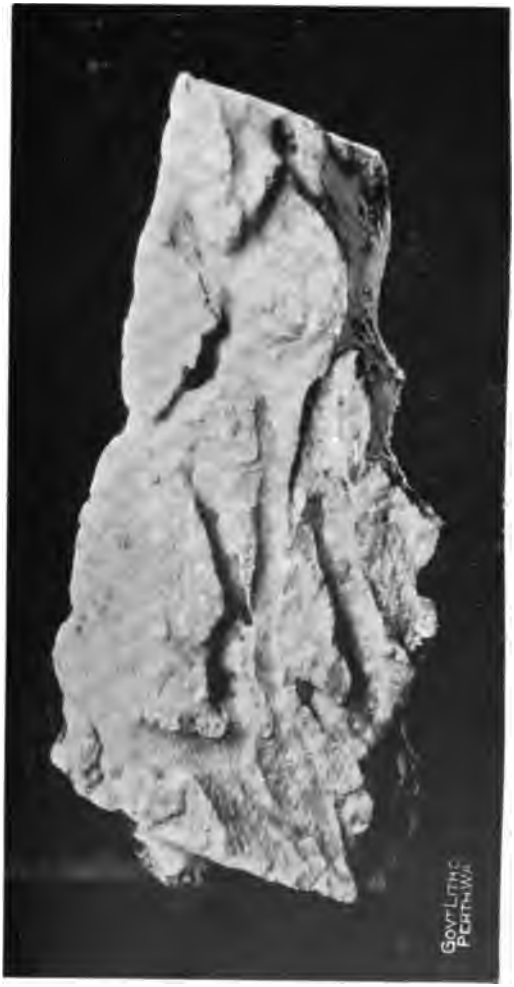


Photo., R. H. Irwin.

A specimen of Worm-bored Rock.

The Cue Victory, G.M.L. 1174. (Plate VII.).—This mine is crossed by the Cue-Nannine railway line about one mile north of the town.

Upon it there are two reefs, the main one, which was formerly known as the Golden Stream, has a general north-easterly course with a dip to the north-westward of 21 degrees, but towards the south end it sweeps round on to a more southerly course after it has joined with the Commonwealth lode, from which point it follows this direction, dipping to the westward under the railway line.

Upon the Golden Stream reef a main underlay shaft has been sunk, which measures 480 feet upon the incline, although the lowest point is only 170 feet below the surface, the water level being 150 feet in vertical depth.

From this shaft four levels have been driven to the southward, No. 1 has fallen in, so that no survey could be made; No. 2 is about 350 feet in length, and in it payable stone was cut at a distance of 100 feet south of the shaft, the whole body of which has been stoped out for a length of 210 feet between this level and the surface. No. 3 level has been driven for a distance of 350 feet, the first 120 feet of which was in barren ground, beyond which the whole of the shoot was stoped for a distance of 220 feet in a solid block up to the No. 2 level. No. 4 level was driven for a distance of 350 feet, the first 170 feet of which was in valueless country, beyond which the lode has been stoped for a distance of 160 feet up to the No. 3 level, whilst below it for a distance on the incline of 40 feet the stone has been underhand stoped.

At the end of this level there is a whip shaft 137 feet in depth, from which the lower portion of the mine is worked.

The reef has been worked at the surface for a length of 200 feet southward from a quartz blow, upon which the battery is situated, to an opencut in which the junction of this reef with the Commonwealth is visible.

The reef varies from a few inches to 5 feet in thickness, averaging about 2 feet, the country being soft kaolinised grano-diorite, often worm-bored. (Photo. No. 11.)

The Commonwealth reef, which is about 15 inches in thickness, splits off from the Golden Stream in the open cut upon a northerly course, dipping at a very low angle to the westward. It follows a very much altered basic dyke, which is called formation, and is from 4 to 20 feet in thickness lying below the reef, whilst its roof is weathered grano-diorite.

This reef has been followed down upon the underlay for distance of over 200 feet, portions of the reef having been entir stoped out, but owing to the fact that the dip is so slight, furth work has been prohibited as it would render the railway line unsaf

There is a ten-head battery upon this lease, with four 40-t cyanide vats, this plant being mostly used for public crushings.

Table showing the Yield of the Golden Stream and Commonwealth Reefs.

Year.	Name and Number of Lease.	Ore crushed.	Gold therefrom.	Rat per t
		tons.	ozs.	ozs
1896	Cue Victory G.M.Ls. 201–208	448·00	612·00	1·3
1897	Do. do. do.	2,818·00	1,820·30	·6
1898	Do. do. do.	3,057·50	1,370·42	·4
1899	Do. do. do.	204·50	55·62	·2
1900	Do. do. do.	...	...	..
1901	Do. do. do.	...	...	..
1902	Do. do. do.	*18·00	1,172·40	..
1903	Do. do. 1174	268·00	713·95	2·6
1904	Do. do. do.	244·00	505·13	2·0
1905	Do. do. do.	214·00	568·47	2·
1906	Do. do. do.	882·00	538·76	·
	Total	8,154·00	7,357·09	·

* Cyaniding sands.

Golden Stream Extended and Republic.—Passing through th two leases is a reef having a north-easterly course with a dip about 30 degrees to the north-west, which has often been suppo to be the eastern continuation of the Golden Stream reef. T however, is not the case, as there is absolutely no connection tween them, although it is quite possible that the individual qu bodies may tenant the same line of fissure.

The shoot of stone in this reef is about 90 feet in length about 4 feet in thickness, and it has been practically worked to the water level, which is 150 feet in vertical depth from the face, below which the reef carries little value and is much smalle

Table showing the Yield of the Golden Stream Extended Reef.

Year.	Name and Number of Lease.	Ore crushed.	Gold therefrom.	Rate per ton.	TOTAL. Ore crushed.	TOTAL. Gold therefrom.	Average Rate per ton.
		tons.	ozs.	ozs.	tons.	ozs.	ozs.
Prior to 1897	Golden Stream Extended G.M.L. 711 ...	20·00	18·95	·94			
1897	Do. do do. 711 ...	30·00	65·69	2·18			
1898	Do. do. do. 711 ...	112·00	183·00	1·64			
1899	Do. do. do. 711 ...	135·00	179·65	1·33			
1900	Do. do. do. 711 ...	830·00	937·08	1·12			
1901	Do. do. do. 711 ...	1,215·00	932·46	·76			
1902	Do do. do. 711 ...	105·00	46·62	·44	2,447·00	2,362·45	·96
1903	Do. do. do. 1359 ...	274·00	112·94	·41			
1904	Do. do. do. 1359 ...	96·00	99·31	1·03			
1906	Do. do. do. 1359 ...	468·00	164·18	·35	1,038·00	566·16	·54
1899	Republic G.M.L. 673	114·00	81·83	·71	114·00	81·83	·71
1904	Golden Stream Extended North G.M.L. 1416	85·00	25·78	·30			
1905	Do. do.	12·00	6·50	·54	97·00	32·28	·33
	Total	...	...	...	3,696·00	3,042·72	·82

The Mystery, late Lady Hynes, G.M.L. 1296 (abandoned).—This old lease is situated upon the northern side of the Cue trig., and a little to the south-east of the quarry. There are two reefs, one of which strikes north-east and the other a little east of north with [illegible] underlay to the eastward.

Upon the westernmost of these several shafts have been sunk in a schistose amphibolite, most work having apparently been done at the south end where the reefs coalesce.

Table showing the Yield of the Lady Hynes Reef.

Year.	Name and Number of Lease.	Ore crushed.	Gold therefrom.	Rate per ton.
		tons.	ozs.	ozs.
1899	Lady Hynes G.M.L. 1165 ...	67·00	50·23	·75
1900	Do. do. 1165 ...	89·00	55·73	·62
1900	Mystery do. 1296 ...	...	1·82	...
	Total	156·00	107·88	·69

About half a mile north of the last-mentioned reef are some old workings upon the south-west edge of the "Pearling Ground." The reef strikes in a north-easterly direction, dipping to the north-west at an angle of 50 degrees, the country being schistose amphibolite up to the north end of the lease, where it changes suddenly into grano-diorite.

This area has changed hands no less than seven times since 1897, during which period the total quantity of stone raised was 256 tons.

Table showing the Yield of the New Eldorado Reef.

Year.	Name and Number of Lease.	Ore crushed.	Gold therefrom.	Rate per ton.
		tons.	ozs.	ozs.
1897	New Eldorado G.M.L. 1045	25·00	4·57	·18
1898	Do. do.	39·50	176·88	4·50
1899	Golden Crow's Nest G.M.L. 1149 ...	10·00	·79	·07
1900	Nil Desperandum G.M.L. 1210 ...	115·00	23·71	·20
1902	Perseverance G.M.L. 1329	24·00	27·38	1·13
1905	Nil Desperandum G.M.L. 1436 ...	36·00	18·92	·53
1906	Star of Hope G.M.L. 1551	6·00	4·70	·78
	Total	255·50	256·95	1·00

Star of Asia, G.M.L. 958 (abandoned).—This is situated upon a quartz blow to the northward of the last-mentioned, the reef strikes upon the same course but although it may possibly be in the same fissure, the quartz body is not continuous across the contact zone of the amphibolites with the grano-diorites, the last-mentioned forming the country of this reef. Fifty-four tons of stone are reported to have been crushed from this reef which yielded 4.57 ozs. of fine gold.

Gem of Cue Extended, G.M.L. 1020.—This lease which is situated about half a mile to the north-eastward of the Cue Vi ory.

has been worked by a company from the earliest days of this field until 1900, but in 1903 it appears to have passed into the hands of the present owner, Mr. Lloyd, who uses the 10-head stamper mill and cyanide vats upon the treatment of stone raised by him from his other properties; the whole production of this mine from the years 1903 to 1906, less than 20 tons crushed, being gold recovered from the sands. The reef strikes a little north of east with an underlay of about 50 degrees to the northward, it was small being about 14 or 15 inches in thickness, lying between a diorite hanging wall and a grano-diorite footwall, and carried good values down to a vertical depth of 100 feet below which it was small and of low grade.

It was worked by an underlay shaft to a depth of 314 feet on the incline, but a vertical shaft was also sunk to a depth of 187 feet, in which a water supply yielding 1,000 gallons per hour was cut at a depth of 120 feet, no connection was made with the old workings but it was utilised as a water shaft.

Table showing the Yield of the Gem of Cue Reef.

Year.	Name and Number of Lease.	Ore crushed.	Gold therefrom.	Rate per ton.
		tons.	ozs.	ozs.
1896	Gem of Cue, late G.M.L. 523, etc. ...	40·00	50·85	1·27
1897	Do. do. ...	20·00	21·89	1·04
1898	Do. do. ...	862·00	555·20	·64
1899	Do. do. ...	4,826·00	2,910·94	·60
1900	Do. do. ...	5,850·00	3,134·24	·53
1903	Gem of Cue Extended, 1020	20·00	706·72	...
1904	Do. do. ...	...	213·59	...
1905	Do. do. ...	...	277·94	...
1906	Do. do. ...	...	307·13	...
	Total	11,744·00	8,250·43	·70

Eclipse, G.M.L. 248.—About 10 chains to the eastward and apparently along the same line of fissure another quartz reef outcrops upon which a considerable quantity of work has been done.

The reef is well defined with a strike a little north of east, and an underlay to the northward at an angle of about 45 degrees, the stone averaging about 2 feet in thickness and it is said to have been going down strong at the bottom where a heavy supply of water was cut.

The shoot appears to be about 5 chains in length at the surface, for which length it has been entirely worked out, whilst the workings have been carried down to the water level which is 100 feet in vertical depth below the surface.

This reef is cut off entirely at the eastern end by a felspar porphyry dyke.

Table showing the Yield of the Eclipse Reef.

Year.	Name and Number of Lease.	Ore crushed.	Gold therefrom.	Rate per ton.
		tons.	ozs.	ozs.
1896	Eclipse G.M.L. 248	72·00	28·96	·40
1897	Do. do.	206·00	89·09	·43
1898	Do. do.	210·00	118·23	·56
1899	Do. do.	142·00	65·97	·46
1900	New Eclipse G M.L. 1243	30·00	20·53	·68
1901	Do. do.	21·00	6·46	·30
1901	Ophir G.M.L. 1278	31·00	10·20	·33
	Total	**712·00**	**339·44**	**·47**

Light of Asia, G.M.L. 1148. (Plate VIII.)—This mine lies close upon the eastern side of the railway line about 2 miles to the northward of Cue; it was in conjunction with the Queen of the May worked up till the year 1897 by a company called the Light of Asia Amalgamated, after which it was taken over by the Cue Consolidated, and for two years no record appears of the crushings which were bulked with the Cue No. 1. In 1900 it passed into the hands of Mr. Lloyd, who has worked it continuously up to the present.

In the early days there was considerable plant upon this lease, but at the present time most of this has been removed, the stone being carted to the Gem of Cue Battery.

The reef, which is of very considerable size in places, varies from a few inches to a thickness of 14 feet, and has a strike a little west of north with a dip of 45 degrees to the westward.

Two shoots of stone have been worked in this lode, which are about three chains apart, whilst the reef fissure is bounded by grano-diorite on the footwall and felspar porphyry on the hanging wall.

An underlay shaft was sunk by the original company to a depth on the incline of 255 feet, from which levels have been driven at vertical depths of 90, 145, and 200 feet; the No. 1 being in 180 feet south and 200 feet north, the No. 2 being 70 feet north and 50 feet south, the No. 3 105 feet north. In these workings the quartz is of a brownish colour in the upper levels and a bluish grey in the lower, and varies from a few inches to 10 feet in thickness.

Most of the stoping has been done between the No. 1 level the surface, but a little has also been done between the Nos. 1 2 from below which no stone has been raised except in the cor of level driving.

The north shoot which is now being worked is a fine solid defined body of quartz; contained between two good walls it att the considerable size of 14 feet in places.

This portion of the lode is worked by a vertical shaft and a horse-whip down to 112 feet (water level), where the shoot is 100 feet wide and 115 feet at the 60 feet level.

Table showing the ***Yield of the Light of Asia Reef.***

Year.	Name and Number of Lease.	Ore crushed.	Gold therefrom.	Rate per ton.
		tons.	ozs.	ozs.
1896	Light of Asia G.M.L's. 964 and 1002 ...	942·00	568·37	·60
1897	Do. do. do. ...	1,782·00	846·37	·47
1900	Do. G.M.L 1148	1,247·00	966·07	·77
1901	Do. do.	1,171·00	602·36	·51
1902	Do. do.	1,129·00	655·19	·58
1903	Do. do.	1,374·00	1,291·35	·94
1904	Do. do.	1,707·00	1,391·46	·81
1905	Do. do.	1,855·00	1,392·67	·75
1906	Do. do.	1,355·00	822·26	·60
	Total	**12,562·00**	**8,536·10**	**·67**

Queen of the May, G.M.L. 1151 (Plate IX.).—This reef strikes off from the Light of Asia in a north-easterly direction, with a dip of from 32 to 46 degrees to the northward.

The lode fissure is traversed by a diorite dyke which in the upper levels is represented by a brown greasy clay, but below the water level it is a solid greenstone heavily charged with pyrites. The walls of this fissure are well defined, showing signs of striation, whilst the quartz lies in the form of a sheet between the dyke matter and the wall, one shoot being upon one side and one upon the other, the whole mass from wall to wall measures from 6 to 10 feet, of which about 2 feet are stone.

Although the dyke matter is so highly altered between the water level, which is 110 feet, and the surface, particles of pyrites and copper ore are met with in the reef at the surface in an unoxidised form.

The water makes in the main shaft at the rate of 10,000 gallons in the 24 hours.

It is worked by a main vertical shaft 260 feet deep, with which levels are connected at 255, 207, and 160 feet, whilst the 160, 110, and 60 feet levels are connected with the No. 1 shaft, which was sunk vertically to a little below the 160 feet level. The western shoot lies upon the boundary of the Light of Asia, partly in that property but dipping into it at the lower level. In the No. 1 level there were 100 feet of it in this mine, at the No. 2 80 feet, at the No. 3 50 feet, whilst at the No. 4 it practically ran out below this level. However, should the shoot continue (of which there is every appearance), it will enter the Queen of the May Extended, G.M.L. 12 belonging to the same owner.

The eastern shoot is separated from the western not only by the dyke, but also by a blank of 130 feet in the No. 1 level, 100 feet in the No. 2 level, and 70 feet in the No. 3 level, whilst the ore body itself is 210 feet in length in the No. 1 level, 170 feet in the No. 2 level, 170 feet in the No. 3 level, and 160 feet in the No. 4 level.

These shoots have a defined dip to the westward, and so far show no diminution in size in depth, whilst the value of the stone has improved.

It is impossible to form a correct estimate of the production of this mine as it was first included in the Light of Asia Amalgamated, and then in the Cue Consolidated up till 1898.

Table showing the Yield of the Queen of the May Reef.

Year.	Name and Number of Lease.	Ore crushed.	Gold therefrom.	Rate per ton.
		tons.	ozs.	ozs.
1899	Queen of the May, 1151...	208·00	160·05	·76
1900	Do. do.	416·00	413·69	·99
1901	Do. do.	847·00	684·54	·80
1902	Do. do.	741·50	531·11	·71
1903	Do. do.	228·00	166·13	...
1904	Do. do.	517·50	622·65	1·20
1905	Do. do.	1,226·00	1,270·09	1·03
1906	Do. do.	1,037·00	1,377·77	1·33
	Total	**5,221·00**	**5,236·03**	**1·00**

The Winchester and Wallace (abandoned).—These old workings are situated about half a-mile to the north-eastward of the Light of Asia upon a reef which has a north-easterly course and an underlay to the north-west.

From the Winchester, 170 tons of stone were crushed before 1898, which yielded 131.54 ounces of fine gold, whilst from the Wallace to the same date, 204 tons crushed yielded 151.61 ounces.

Normanby, G.M.L. 1143 (abandoned).—This mine is a quarter of a-mile in a south-easterly direction from the last-mentioned, the reef in which strikes north-east with a dip of 70 degrees to the north-west.

It was worked by an underlay shaft to a depth of 120 feet, which is the water level, and it is between this and the surface th t all the work has been done.

This lode, which is two feet in width, is in grano-diorite count ; the fissure containing a felspar porphyry dyke as well as the qua z vein.

Up to the year 1898, this lease was worked by the W . Venture Syndicate.

Duke of York Deeps, G.M.L. 1421 (abandoned).—This adjoins the Normanby to the eastward, and is possibly upon the same reef, but certainly upon the same dyke fissure.

It formed originally a portion of G.M.L. 799, when a certain amount of development was done upon it, from which, later on, 217 tons of stone were raised.

Table showing the Yield of the Normanby Reef.

Year.	Name and Number of Lease.	Ore Crushed.	Gold therefrom.	Rate per ton.
		tons.	ozs.	ozs.
1896	Normanby G.M.L. 799	295·00	243·46	·82
1897	Do do	310·00	200·30	·64
1898	Do do	40·00	38·30	·96
1899	Do 1143	172·00	235·98	1·37
1900	Do do	146·00	123·43	·84
1901	Do do	131·00	92·02	·70
1902	Do do	78·50	107·91	1·37
1903	Do do	15·00	11·33	·75
1901	New North Cue G.M.L. 1255	77·00	40·09	·52
1904	Duke of York Deeps G.M.L. 1421 ...	20·00	8·89	·44
1905	Do do ...	120·00	25·42	·21
1906	Do do ...	15·00	1·77	·12
	Total	**1,409·50**	**1,128·90**	**·80**

Duke of York, G.M.L. 1275.—This reef, which has a course north-westerly and dips to the south-west, is situated a little to the eastward of the last-mentioned.

It was known as the Great White Eye until the year 1900, after which it was repegged and worked under its present name.

The reef is about 4 feet wide upon the average, and the shoot, which is 180 feet in length at the 160 foot level (water), has a decided dip to the north, so much so, in fact, that only 30 feet of the shoot is in this property at this level, the balance being in the Duke of York Extended. A main vertical shaft has been sunk upon the Duke of York West Extended to a depth of 310 feet, the water level being 109 feet.

In this shaft a so-called formation (felspar porphyry dyke) was cut accompanied by a little quartz which carried no values, this is probably the reef fissure, but since the rich shoot had such a decided dip to the northward there was not any prospect of it being met with in this shaft, which is some four or five chains south of where it should be.

Duke of York Extended, G.M.L. 1287 (abandoned).—This is the northern extension of the same reef, which was of little value at the surface, but since this shoot dipped into it the lower levels turned out good stone. At the water level, to which depth the mine has been worked, there are 150 feet of the shoot in this property.

The main vertical shaft has been sunk to a depth of 209 feet, but little work appears to have been done below the water level. The porphyritic dyke occurs with the lode [**3814**, **3797-8**].

Table showing the Yield of the Duke of York Reef.

Year.	Name and Number of Lease.	Ore crushed.	Gold therefrom.	Rate per ton.	Total.	
					Ore crushed.	Gold therefrom.
		tons.	ozs.	ozs.	tons.	ozs.
1896	Great White Eye G.M.L. 882	190·00	110·88	·58		
1897	Do. do. ...	59·00	32·54	·55		
1898	Do. do. ...	241·00	88·01	·36		
1899	Do. do. ...	81·50	50·33	·61		
1900	Do. do. ...	17·00	12·09	·71		
					588·50	293·85
1901	Duke of York G.M.L. 1275	111·00	100·64	·90		
1902	Do. do. ...	440·00	296·84	·67		
1903	Do. do. ...	1,143·00	1,002·69	·87		
1904	Do. do. ...	225·00	63·90	·28		
1905	Do. do. ...	307·00	167·92	·54		
					2,226·00	1,631·99
1903	Duke of York Extended G M.L. 1287	174·00	109·00	·63		
1904	Do. do. ...	1,316·00	655·06	·49		
1905	Do. do. ...	729·00	358·81	·49		
					2,219·00	1,122·87
	Total	...	...	...	**5,033·50**	**3,048·71**

The Agamemnon, G.M.L. 1047. (Plate X.)—This mine is situated upon the north side of a quartz blow about half a mile south of the Duke of York; it was originally worked by a company called the Agamemnon Ltd., who also owned the Tasmania and the Salisbury, the crushings from which were included with the returns from this mine for the years 1898 and 1899.

This company had a plant upon the mine consisting of a 15-head battery with four 40-ton cyanide vats and all necessary winding and pumping plant, but this has now been all removed, as the present owner crushes the stone at his battery upon the Gem of Cue.

This reef is large, forming a conspicuous hill having a general course east and west with a dip of 30 degrees to the northward; it is from 2 to 9 feet in thickness and lies between good walls, one being grano-diorite and the other a basic weathered dyke [**3796**].

There are two well-defined shots of stone, the western of which was worked by the company, who sank a vertical shaft to a depth of 180 feet with a crosscut 31 feet south to the No. 1 level, and another 57 feet north to the No. 2. The No. 1 level was driven 250 feet west and the same distance east, whilst the No. 2 was driven 250 feet west and 150 feet east.

Above the No. 1 level the lode has been stoped for a length of 380 feet to the surface, whilst between the Nos. 1 and 2 the stone was removed for a length of 210 feet.

From the bottom level the reef has been sunk upon for a further distance of 100 feet, but no stoping has been done.

The second or new shoot which is a few chains east is being worked at the present time, it is of considerable size and has been followed down to the water level, which is about 120 feet in vertical depth.

In these workings there are two small throws, one up and one down, but they are of no serious importance.

The large blow to the eastward also carries a little gold, but since it requires simply quarrying it is used to keep the mill going when there is a shortage of higher grade stone.

Table showing the Yield of the Agamemnon Reef.

ear.	Name and Number of Lease.	Ore crushed.	Gold therefrom.	Rate per ton.	Total. Ore crushed.	Total. Gold therefrom.	Average Rate per ton.
		tons.	ozs.	ozs.	tons.	ozs.	ozs.
96	Agamemnon G.M.L. 1047	50·00	45·32	·90			
97	Do. do. ...	1,365·50	1,255·89	·92			
98	Do. do. ...	3,324·00	2,012·99	·60			
99	Do. do. ...	1,955·00	1,080·02	·55			
00	Do. do. ...	359·00	255·20	·71			
					7,052·50	4,649·42	·66
00	Do. do. ...	134·00	66·88	·49			
01	Do. do. ...	823·00	474·68	·57			
02	Do. do. ...	1,044·33	816·84	·77			
03	Do. ao. ...	275·00	206·43	·75			
04	Do. do. ...	659·00	438·88	·65			
05	Do. do. ...	923·00	424·29	·45			
06	Do. do. ...	1,859·00	1,077·57	·62			
					5,717·53	3,505·57	·61
96	Tasmania G.M.L. 483 ...	55·00	21·72	·39			
					55·00	21·72	·39
	Total	...	...	...	12,825·03	8,176·71	·63

Immediately north of the Agamemnon are some very old works upon a well-defined reef which strikes north-east and dips north- which was called the Gibraltar, G.M.L. 669, from which 18 tons of stone were raised and crushed in 1897 which yielded 28 ounces of fine gold.

North Bismark, G.M.L., 1442, and *Sarepta, G.M.L.* 1272 (abandoned).—These are situated close to the contact of the grano-diorite with the amphibolites and about one and three-quarter miles north-east of Cue.

The reef strikes a little to the east of north, dipping to the north-west at an angle of 52 degrees, and is about 2 feet in width.

It rises from the flat at the north end in the North Bismark, culminating in a blow in the Sarepta at the south near the contact where it suddenly comes to an end.

A number of shallow shafts have been sunk from which 331.25 tons of stone have been raised from the two leases which yielded 205.96 ounces of fine gold.

Fleur de Mai, G.M.L. 422 (abandoned).—This is an old lease situated about three miles to the eastward of Cue, which has not been worked since the year 1898.

The reef strikes in an easterly direction with a dip to the northward, and is three feet in width, the country being schistose amphibolite. A shaft has been sunk to a depth of 70 feet from which a level was driven 20 feet east and 28 feet west at a depth of 35 feet below the surface.

From this mine 452 tons of stone were crushed which yielded 226.79 ounces of fine gold, equal to about half an ounce to the ton.

The Rose, G.M.L. 1110 (abandoned).—This old lease is situated about half way between the last-mentioned and Cue, the reef has a north-easterly course following a line of porphyritic dyke, which can be traced for a distance of a mile in that direction, the dip is westerly at about 80 degrees, the quartz body being about 18 inches in width.

A considerable quantity of work has been done, the deepest shaft being about 160 feet in vertical depth in the upper portions, this shaft passed through foliated amphibolite but this, deeper down, became massive [3820-2].

A large supply of good water was struck which is at present held as a water right.

The total quantity of stone crushed from it was 375 tons which yielded 84.25 ounces of fine gold.

A little to the eastward are two abandoned leases called the Olive and Pension, in which a ferruginous reef with a north-easterly strike and westerly dip has been worked to a shallow depth, yielding a total of 99 tons of stone from which 113.45 ounces of fine gold were obtained [6898].

Happy Jack, G.M.L. 1509, *Maybell, G.M.L.* 1108, *and Marvel, G.M.L.* 599.—Upon the south-eastern side of the railway line and about 20 chains north-east of the cemetery are a group of leases, the reef in which strikes in a north-westerly direction with a dip to the north-eastward at an angle of about 40 degrees, in the Marvel it is about 18 inches and the country amphibolite. From this lease 50 tons of stone were crushed in 1897, which yielded 18.61 ounces of fine gold.

The Happy Jack line is immediately to the north-westward of the last-mentioned and upon it a fair-sized body of stone is being worked which although it follows the same line of fissure as the Marvel is not a continuous body of stone.

A considerable quantity of work has been done upon this reef for a length of 5 chains along the outcrop, whilst recently a vertical shaft has been sunk to the dip with the object of facilitating the work.

From this reef 274 tons of stone have been treated which yielded 259 ounces of fine gold.

The Maybell is situated a few chains to the westward of the last, and follows a more northerly course but still dips to the eastward.

Only a little work was done on this lease and that as far back as 1897, when a parcel of 15 tons of quartz was crushed which yielded 4.57 ounces of fine gold.

The Catalpa, G.M.L. 1271.—At the south-east corner of the town and upon the western side of the railway line is a reef which rises abruptly from a low hill forming a wall-like outcrop of about 10 feet in height for several chains in length. This reef which contains a little galena is from 2 to 4 feet in width, strikes in a north-easterly direction and dips at an angle of 85 degrees to the north-westward.

A vertical shaft has been sunk to a depth of 113 feet in serpentine schist [3892-3], the water level being 100 feet from the surface where the lode was driven upon for a length of 300 feet. The shoot of stone is said to have been 80 feet in length from which 750½ tons of stone were crushed which yielded 268.06 ounces of fine gold, but as there is no record of what the sands yielded this is not the total yield.

In the year 1899, a 20-head battery was erected upon this lease but as the mine was closed down shortly after it was never used.

The mine is now being reopened by a company who are doing a considerable amount of boring.

At the north end of this reef was the Duchess, G.M.L. 1281, but the workings from which 30 tons, which yielded 9.66 ozs. of fine gold, were obtained have been filled in as it is in the centre of the town.

Princess Royal, G.M.L. 222. (Plate XI.)—This mine lies within the greenstone area upon the south side of the town to the westward and adjoining the Hospital Reserve. It, with several adjoining leases, was worked until recently by a company under the name of the Princess Consolidated Murchison Ltd., but owing to litigation it has passed into the hands of Mr. McDermott, the former manager.

The reef, which ends in a large quartz blow to the northward, has a north-easterly course, but splits in two to the southward, the Royal reef taking a turn more south-westerly, whilst the other branch, which maintains its normal course, has been called the Royal Secret. Both branches dip to the westward at an angle of 48 degrees, and after running a course in a south-westerly direction for about 15 chains from the blow, they are completely lost.

The only portions of the reefs which carry any values are to the southward of their junction, and it is upon the two branches that a considerable amount of work has been done. Upon the Royal reef, which varies from 2 to 5 feet in width, a main shaft was sunk at the north end of the shoot to a depth of 107 feet from which, at a depth of 100 feet, a crosscut was driven 50 feet east which cut the reef, the latter being driven upon (No. 1 level) for a distance of 340 feet south in ore the whole way. From the plan little stoping appears to have been done above this level for the first 150 feet, and none below, but from the remainder all the ore has been taken out up to the surface and down the No. 2 level. The No. 2 level, which is in 170 feet in vertical depth below the surface, is connected with the old main shaft by an underlay, and was driven south for a distance of 340 feet ; from the last 190 feet all the ore has been stoped above to the surface, but none from below.

Above the No. 1 level at the north end the reef became very small, and therefore the stopes were not carried up ; it has recently been discovered, however, that the reef is split by an intrusion some 3 or 4 feet in width, and that there is a good body of stone upon the other wall, which is now being worked up to the surface, this contains a considerable quantity of manganese [**6889-90**].

In order to facilitate working, a new main vertical shaft was sunk to the westward to a vertical depth of 264 feet, and from this a crosscut was driven to a depth of 255 feet south-south-east for a distance of 80 feet, where a body of stone 4 feet in thickness was cut and driven upon for a distance of 12 feet.

In this shaft a good supply of water was struck at 110 feet, whilst at a depth of 140 feet a hard belt of epidiorite was encountered. which continued to the bottom, and also enclosed the reef. [6891].

The Royal Secret branch is not so large a body of stone, being from 3 inches to one foot in thickness, and it extends for a distance of 3 chains from the junction, for which length it has been stoped to a depth of 80 feet upon the underlay.

There was originally a ten-head battery, four 30-ton cyanide vats, and hauling machinery upon this mine, but it is now mostly dismantled.

Table showing the Yield of the Princess Royal Reef.

Year.	Name and Number of Lease.		Ore crushed.	Gold therefrom.	Rate per ton.
			tons.	ozs.	ozs.
Prior to 1897	Princess Royal G.M.L. 222		414 00	827·67	1·99
1897	Do.	do.	3,132·50	2,603·42	·83
1898	Do.	do.	2,349·00	1,582·56	·67
1899	Do.	do.	...	...	...
1900	Do.	do.	33·00	35·86	1·08
1901	Do.	do.	348·00	449·17	1·29
1902	Do.	do.	...	282·34	...
1904	Do.	do.	530·00	263·29	·49
1905	Do.	do.	219·00	287·73	·88
1906	Do.	do.	360 00	355·66	·95
1902	Royal Secret G.M.L. 1295 ...		419·50	368·21	·87
1904	Do.	do. 1411 ...	62·00	19·66	·31
	Total		**7,870 00**	**7,075·57**	**·89**

Lady Forrest, G.M.L. 1375. (Plate XII.)—This old mine is situated within the amphibolite area upon the western side of the road to the south-westward of the Princess Royal.

It strikes east and west, but branches to the eastward, the straight reef being called the Lady Forrest and the northerly one Essler's reef. They both dip at an angle of about 60 degrees to the so hward, the main reef being 12 feet in width at the surface and 18 eet at the 90 feet level.

It was originally worked by a main vertical shaft, which is 11 feet in depth, the reefs being driven on at a depth of 90 feet as e water level is at 95 feet, but later on a main underlay shaft wa unk upon Essler's lode to the 90 feet level.

From this latter the reef was driven on at the 90 feet level in a south-westerly direction for a distance of 150 feet to its junction with the Forrest reef, which was driven on 230 feet east and 90 feet west.

At the 75 foot level the Forrest reef was driven in 87 feet, and at the 31 foot level 70 feet, but very little stone was stoped.

There was originally a 20-head battery upon this mine, but this was removed when the company gave it up in 1897, since which time it has been worked by three different parties.

Table showing the Yield of the Lady Forrest Reef.

Year.	Name and Number of Lease.	Ore crushed.	Gold therefrom.	Rate per ton.
		tons.	ozs.	ozs.
1897	Lady Forrest G.M.L. 335	920·00	471·94	·57
1900	Do 1217	57·00	57·62	1·10
1901	Do do	137·00	103·94	·75
1902	Cue Fingall G.M.L. 1312	26·00	8·35	·31
1903	Easter Monday G.M.L. 1375	36·00	7·24	·20
	Total ...	**1,176·00**	**649·09**	**·66**

Polar Star, G.M.L. 1277. (Plate XIII.)—This mine is situated upon the southern boundary of the Cue mining district, about one mile and a half to the westward of the town.

It was worked from 1896 to 1899 by a company who did a considerable amount of work upon it and erected a 10-head battery. During the next three years it was vacant, then it became the property of the Murchison Associated Gold Mines, Ltd., when further developments were carried on and a small quantity of stone crushed; during the last two years, however, it has been used only for supplying water to the Rubicon mine, which is owned by the same company.

The reef is within the grano-diorite area, but close to the contact, and appears to be associated with an epidiorite and felspar porphyry dykes, it strikes to the north-eastward, dipping at an angle of from 63 to 70 degrees to the north-westward [3835, 6866-71].

Upon it a vertical shaft has been sunk to a depth of 270 feet, from which a crosscut has been driven 7 feet to the northward at the 238 feet level (No. 4) where the reef has been followed on its course for 40 feet west. The No. 3 level has been driven 15 feet east and 45 feet west of the main shaft at a depth of 208 feet. The No. 2 level, which is in 40 feet west, is connected with the main shaft by a crosscut 32 feet at the 140 feet level. At a vertical depth of 80 feet a crosscut has been driven to the lode a distance of 53 feet south, which has been followed in the No. 1 level for a distance of 160 feet both east and west.

To the westward about 200 feet along the outcrop are two old shafts which have been sunk to an intermediate level, which is 210 feet in length, one of these shafts was also carried on down to the No. 1 level.

Table showing the Yield of the Polar Star Reef.

Year.	Name and Number of Lease.	Ore crushed.	Gold therefrom.	Rate per ton.
		tons.	ozs.	ozs.
Prior to 1897	Polar Star Prop., Ltd., G.M.L. 920	179·00	385·47	2·15
1897	Do do	339·00	513·83	1·51
1898	Do do	198·00	9·42	·04
1899	Do do	108 00	30·78	·28
1903	Do G.M.L. 1277	81·00	110·98	1·37
1904	Do do do	25·00	6·73	·23
1906	Do do 1616	16·50	7·81	·47
	Total	**946·50**	**1,065·02**	**1·12**

Homeward Bound, G.M.L. 1211 (abandoned).—This old mine is situated about 20 chains to the south-westward of the Polar Star, it was worked in the early days of the field upon a reef which strikes in a north-easterly direction and dips to the north-west, the country being amphibolite with epidiorite dykes [**3878, 3882, 6872-4**].

The reef was of considerable size but poor, the gold being carried in small leaders associated with scheelite, and has been tested to a depth of 160 feet, the water level being 100 feet, below which the country is extremely hard.

Table showing the Yield of the Homeward Bound Reef.

Year.	Name and Number of Lease.	Ore crushed.	Gold therefrom.	Rate per ton.
		tons.	ozs.	ozs.
Prior to 1897	Homeward Bound G.M.L. 398	39·00	67·88	1·74
1897	Do. do. do.	8·50	5·49	·64
1901	Cue Homeward Bound G.M.L. 1211	16·00	12·42	·77
	Total	**63·50**	**85·79**	**1·35**

Table showing the Yield of the Productive Leases in the Cue District.

Name and Number of Lease.		Ore crushed.	Gold therefrom.	Rate per ton.
		Tons.	Ozs.	Ozs.
b Agamemnon, Ltd.	483, 1046 and 1047	7,053·50	4,649·42	·66
c Agamemnon	1047 and 1310	5,717·53	3,505·57	·61
a Arcadia	640, 811, 870, 953, 1138	2,395·50	1,602·05	·67
a Arcadia North	1247	23·50	3·40	·14
a Argus	1328	1,134·30	679·52	·59
a Ashbourne	750	669·00	491·43	·73
a Battler's Hope	1284	30·00	8·49	·28
a Bedford	1366	10·00	303·63	30·36
a Belgravia Leases	1056 and 1057	102·00	69·69	·68
a Belgravia Central	789	179·50	204·03	1·13
a Brilliant G.M., N.L.	1115	46·00	14·54	·31
a Buttercup	1109	100·00	58·54	·58
b Caledonia Hill	1068	100·00	101·16	1·01
c Comforter	1234	93·00	41·19	·44
b Catalpa	1088	208·50	72·78	·35
b Catalpa	1271	519·50	189·03	·36
b Catalpa South	1089	23·00	6·28	·27
a City of St. Petersburg	764	10·00	4·52	·45
a Conscript	1067	12·00	9·96	·83
a Countess	1066	408·00	356·13	·87
a Countess	1212	10·00	7·76	·77
a Countess G.M., N.L.	1212 and 1230	164·00	79·68	·48
c Countess Extended	1386	2,426·00	1,294·53	·53
b Cue Consolidated G.M., Ltd.	60, 170, 203, 674, 692, 964, 1002, 1128, 1130, and 1148	23,427·50	18,382·10	·78
a Cue Fingall	1312	26·00	8·35	·31
a Cue Homeward Bound	1211	16·00	12·42	·77
	202 and 892	10,503·00	8,481·17	·80
		[illegible]	12,009·96	1·58

b Cue Victory G.M., Ltd.	201, 208, 893, 935, and 825	6,546·00	5,030·78	·77
	1174	1,608·00	2,826·31	1·44
Deceiver	1115	1,423·60	2,117·18	1·48
Deceiver North	1213	168·00	337·22	2·00
b Duchess	1281	30·00	9·66	·32
c Duke of York	1275 and 1344	2,226·00	1,631·99	·73
a Duke of York	1022	30·00	27·15	·90
a Duke of York Deeps	1421	155·00	36·08	·23
a Duke of York Extended	1287	2,219·00	1,122·87	·50
a Easter Monday	1375	36·00	7·24	·20
a Eclipse Leases	248 and 663	630·00	302·25	·48
a Gem	1216	32·00	14·60	·46
c Gem of Cue Extended	1020	20·00	1,504·38	
b Gem of Cue, Ltd.	523, 1020, 1044, 1127, 1152, and 1154	11,724·00	6,746·05	·57
a Gem of Murchison, G.M., Ltd.	538 and 993	60·00	35·67	·59
a George Higinbotham	178	178·00	79·80	·44
a Golden Crow's Nest	1149	10·00	·79	·07
a Golden Garter	1111	620·00	225·50	·36
a Golden Gem	1220	10·00	4·74	·47
a Golden Leaf	889	33·00	42·54	1·29
b Golden Stream Extended	711	2,447·00	2,362·45	·96
c Golden Stream Extended	1359	1,038·00	566·16	·54
a Golden Stream North Extended	1416	97·00	32·28	·33
b Great White Eye	882	588·50	293·85	·49
c Happy Jack	1509	274·00	258·91	·94
a Hard Luck	1159	96·00	55·81	·58
a Hard Nails	1439	46·50	23·18	·49
a Heart of Oak	1427	129·00	73·11	·56
a Highland Mary	718	68·00	7·32	·10
a Homeward Bound	398	47·50	73·37	1·54
a Independent	173	30·00	19·00	·63
c Jubilee	1511	1,110·00	378·19	·34

a Abandoned leases. *b* Abandoned leases now held under other names. *c* Existing leases at the end of 1906.

Table showing the Yield of the Productive Leases in the Cue District—continued.

Name and Number of Lease.		Ore crushed.	Gold therefrom.	Rate per ton.
		Tons.	Ozs.	Ozs.
a Kangaroo	1306	454·50	283·13	·62
a Kangaroo	672	318·00	161·51	·50
a Lady Forrest	335, 696, and 1051	1,114·00	633·50	·57
a Lady Godiva	1116	207·00	114·16	·55
a Lady Haynes	1165	156·00	105·96	·67
b Lady Mary Amalgamated G.M., Ltd.	60, 170, and 674	3,151·00	3,189·25	1·01
b Lady Mary No. 1 South	157	435·50	814·06	1·87
a Le Premier Fleur de Mai	422	452·00	226·79	·50
a Leviathan	183	1,148·50	849·40	·74
b Light of Asia Amalgamated G.M., Ltd.	964 and 1002	2,724·00	1,414·74	·52
c Light of Asia	1148	9,838·00	7,121·36	·72
a Lily	701	623·00	869·92	1·39
a Lily	1494	246·50	151·56	·61
a Lily North	1049	70·00	191·28	2·73
a Lily North Extended	1131	75·00	129·93	1·73
a Lily No. 2 South	697	35·00	23·57	·67
c Little Gem	1542	64·00	62·84	·98
a Little Sparkler	1499	74·50	46·80	·63
a Lombardy	1034 and 1035	345·00	215·17	·62
a Mafekin	1339	138·00	25·62	·18
a Mafekin	1175	97·00	84·42	·87
a Maori	1418	49·00	21·74	·44
a Maori Chief	537	...	59·00	...
a Marvel	599	50·00	18·61	·37
a Maud	1144	152·00	161·89	1·06
a Maybell	1108	15·00	4·57	·30
c Monte Carlo	1530	338·00	198·46	·58

a New Arcadia	1311	591·00	364·60	·61
a New Arcadia North	1355	100·00	34·04	·34
a New Arcadia North Extended	1458	58·50	33·81	·57
a New Eclipse	1243	51·00	26·99	·52
a New Eldorado	1045	64·50	181·45	2·81
a New England	1107	7·00	8·23	1·03
a New Gem of Murchison	1314	39·00	21·35	·54
a New Leviathan	1390	306·00	174·51	·57
a New North Cue	1255	77·00	40·09	·52
a New Venture	1161	24·00	4·73	·19
c New Volunteer	1135	4,559·00	3,684·52	·80
c New Volunteer Extended	1259	229·00	154·19	·67
a Nil Desperandum	1210	151·00	42·63	·28
a Normanby	1143	542·50	570·67	1·05
a North Bismarck	1442	136·75	110·09	·80
a North Victoria	817	203·00	283·00	1·39
c North Volunteer	1127	27·00	7·72	·29
a Old Francis	1429	28·00	8·00	·28
c Old Princess Ada	1481	889·00	428·18	·48
a Olive	1399	11·00	5·46	·49
a Ophir	1278	31·00	10·20	·33
a Pension	1395	88·00	107·99	1·11
a Perseverance	1329	24·00	27·28	1·13
b Polar Star	1277	72·50	64·10	·88
c Polar Star	1616	16·50	7·81	·47
b Polar Star Proprietary, Ltd.	920	824·00	939·50	1·14
c Princess Ada	1433	1,777·00	677·33	·38
a Princess Ada South	1059	64·00	8·73	·13
b Princess Leases	1150 and 1178	1,790·00	1,354·96	·75
b Princess Murchison Consolidated, Ltd.	222, 653, 1016, 1048, and 1114	6,806·50	6,044·31	·88
c Princess Royal	222	582·00	643·39	1·10
c Queen of the May	1151	5,221·00	5,226·03	1·00

a. Abandoned leases. *b*. Abandoned lease snow held under other names. *c*. Existing leases at the end of 1906.

Table showing the Yield of the Productive Leases in the Cue District—continued.

Name and Number of Lease.		Ore crushed.	Gold therefrom.	Rate per ton.
		Tons.	Ozs.	Ozs.
a Real MacKay	1266	40·00	13·77	·34
a Red White and Blue	745, 746, 1119, and 1121	1,103·00	490·93	·44
a Republic	673	114·00	81·83	·71
a Research	1333	24·00	14·92	·62
a Retreat	1328	45·00	23·01	·51
c Rising Sun	1248	1,198·00	838·62	·70
b Rising Sun North	1262	56·00	36·03	·66
b Rising Sun North	1500	15·00	1·08	·07
a Rose	1110	21·00	10·98	·52
c Rose	1576	127·00	92·92	·73
a Rose of England	662	300·00	38·01	·13
a Rose of England	1286	54·00	35·26	·65
a Royal North	1379	20·00	5·65	·28
a Royal Secret	1411	481·50	387·87	·80
c Salisbury	1374	7,342·50	5,477·27	·74
a Sarepta	1272	194·50	95·87	·49
c South Volunteer	1044	5,479·00	2,733·85	·49
a Stanmore	887	63·00	59·73	·94
c Starlight	1325	1,506·50	1,473·40	·97
a Star of Asia	958	54·00	4·57	·08
c Star of Hope	1551	6·00	4·70	·78
a Struggle	1153	125·00	31·29	·25
c Success	1504	24·50	22·92	·93
a Tasmania	483	55·00	21·72	·39
a Twilight	774	2,357·50	1,807·25	·79
a Twilight South	1090	341·00	205·35	·60
a Two Lillies	1113	180·00	172·30	·95
	865	10·00	9·05	·90
a Two Nations	1279	108·00	34·84	·32

	1177	74·50	358·23	4·82
	1354	503·50	242·74	·48
Volunteer ...	1070	199·50	212·78	1·06
a Volunteer Deeps	1323	20·00	2·01	·10
a Volunteer North	1350	121·50	29·73	·24
c Volunteer South Extended	1145	20,068·00	10,829·10	·54
a Wallace	999	34·00	20·07	·59
a W.A. Venture Syndicate, Ltd.	799	645·00	482·06	·74
a Welcome	1308	130·00	46·53	·35
a West Australian	1172	100·00	9·39	·09
a Winchester	1009	170·00	131·54	·77
a Young Colonial	1297	197·50	264·63	1·34
Sundry claims		5,140·25	3,699·08	·72
Sundry parcels crushed prior to 1899		2,154·00	3,166·30	1·47
Do treated at Cue Public Battery		2,576·00	1,287·73	·49
Do do Cue No. 1 Battery and Works		2,463·50	1,102·71	·44
*Do do Cue Victory Battery		1,388·52	4,061·56	2·91
Sands treated by Cue Gold Recovery Co.		...	4,369·45	
Do Lady Mary Cyanide Works		...	3,180·40	
Do Gem of Cue Cyanide Works		...	4,786·83	
Total		201,952·85	169,433·53	·83

a. Abandoned leases. *b*. Abandoned leases now held under other names. *c*. Existing leases at the end of 1906.

* Includes a considerable quantity of sands cyanided.

SECTION III.—THE CUDDINGWARRA SUB-MINING DISTRICT.

(With a Geological Map.)

GENERAL.

This mining centre, which was discovered in the year 1891, was originally known as the Dead Finish; it is about seven miles to the north-westward of Cue, with which town it is connected by a telephone, and a mail service twice a week.

It lies upon the eastern side of a range of hills which terminate at a point a little to the northward of the town where one of the main drainage channels flowing towards Austin's Lake crosses this belt in a south-westerly direction. In the bed of this channel several fine fresh water pools have been formed, which furnish not only the domestic supply of the district but also the boiler feed-water to the Victory United Mine.

To the eastward of the town is a stretch of comparatively low and level country, covered by large alluvial flats from which rise occasionally razor-backed ridges or isolated rocky hills or pinnacles (Photo. No. 12).

From these flats, which are for the most part strewn with quartz and ironstone fragments and covered by a coarse salt herbage, there is a fall both towards the north and south, but so slight that no watercourses have been formed, and, as a consequence, after heavy rains large areas are flooded.

One of the great drawbacks to prospecting in this district is the large volume of salt water met with at a very shallow depth, whilst the water level appears to be closer to the surface at the present time than it was in 1895, since a difference of about 10 feet exists in every instance mentioned by Mr. Goczel in his report of that date.

Timber for mining purposes is very scarce, and has to be carted in from a considerable distance, whilst even the firewood supply is fast becoming a serious item.

Since its discovery this district is credited in the official statistics with the production of 26,629 tons of stone which yielded 35,293 ounces of fine gold, being at the rate of about one ounce six dwts. of gold per ton, but owing to the fact that it was not compulsory for companies to furnish the Government with returns until the year 1897, five years of the most prosperous portion of this district's existence had passed, of which there is no authentic record.

Since the year 1897, the records show that 29 out of the total number of leases held have been productive; these upon analysis prove to represent only 15 areas, some of which have been held and

PHOTO. 12.

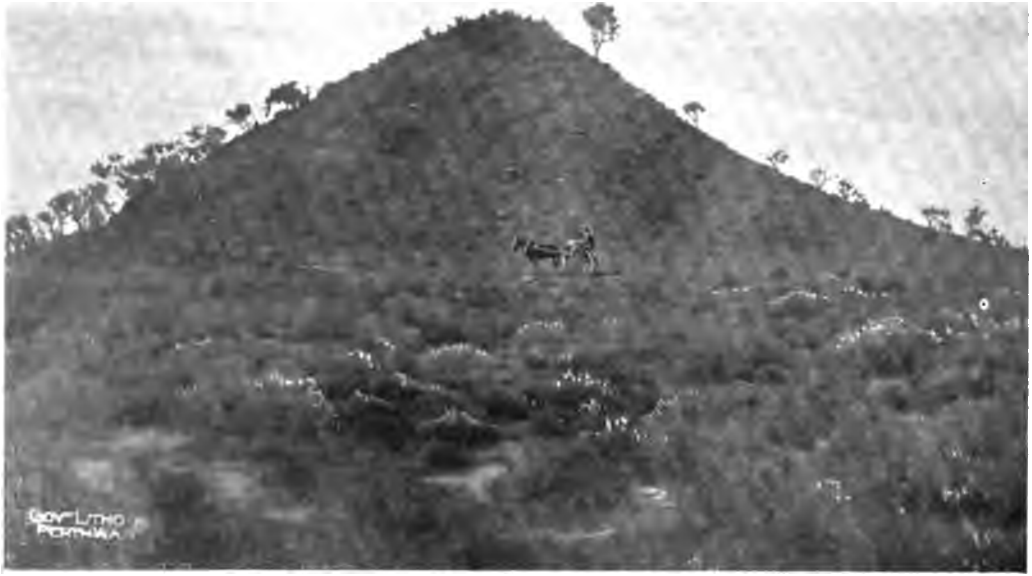


Photo , H. P. Woodward.

abandoned more than once under changed names. At the present time only three leases are in force, of these the Victory United Company holds two, whilst the other, now known as the Emily, is the same ground as held previously under the names of the Golden Fleece, Windmill, and Oxonian, and it is being reopened by a working party.

Little alluvial gold was won in this district, the patches being poor, small, and shallow, but there is no record of the actual quantity obtained.

The following table gives the official figures of the total production of each lease held in this district up till the end of 1906.

Table showing the Yield of the Production Leases of the Cuddingwarra District up to 1906.

Year.	Name and number of Lease.	Ore crushed.	Gold therefrom.	Rate per ton.
		tons.	ozs.	ozs.
1900	Amy Florence G.M.L. 1166	176·00	221·44	1·26
1897	Black Swan G.M.L. 867 ...	60·00	137·15	2·28
1899	Blue Bell G.M.L. 846 ...	72·00	15·86	·22
Prior to 1897	Blue Bell Proprietary G.M L. 925, etc.	84·00	243·46	
Prior to 1897	Bonanza G.M.L. 1055 ...	42·00	38·01	·90
1897 to 1901	City of Chester G.M.L. 525	1,359·00	1,045·44	·77
1900	City of Sydney G.M.L. 1235	95·00	86·10	·89
1905–6	Emily G.M.L. 1510	76·50	90·49	1·18
1897	Fairlight G.M.L. 386 ...	150·00	72·26	·48
1896–7	Fortune of War G.M.L. 95	2,231·00	2,041·38	·91
Prior to 1897	Golden Fleece G.M.L. 1873	84·00	58·83	·70
1895 to 1903	Golden Gate G.M.L. 634, etc.	4,690·50	4,263·39	·90
1895 to 1897	Greymouth G.M.L. 968 ...	170·00	445·49	2·62
1898	Kallara G.M.L. 716 ...	...	36·00	
1896 to 1898	Lady Rosie G.M.L. 790 ...	275·00	241·60	·89
1899	Laura G.M.L. 1160	130·00	23·05	·17
1899	Moonlight G.M.L. 505 ...	15·50	5·57	·36
1899–1900	Oxonian G.M.L. 1146 ...	174·00	219·77	1·26
1896–1891	Rheingold G.M.L. 671 ..	333·00	342·76	1·02
1904–5	Rheingold G.M.L. 142 ...	97·00	69·54	·71
1900	Rose G.M.L. 1238	10·00	2·65	·26
1903	Royal Mint G.M.L. 1376 ...	141·00	106·32	·75
1904–5	Royal Mint 1422	287·00	179·54	·62
1904–5	Scotia G.M.L. 1440	932·00	273·67	·29
1903	South Victory G.M.L. 1364	58·00	53·75	·92
1900	Venus G.M.L. 1215	...	9·49	
1901	Venus G.M.L. 1268	...	4·92	
1894 to 1906	Victory United G.M.L. 595 etc.	14,456·00	24·828·77	1·71
1905	Whisper Low G.M.L. 1491	21·00	19·77	·94
1898	Windmill G.M.L. 1120 ...	127·25	63·23	·49
	Sundry Claims	283·50	222·07	·78
	Total	26,644·25	35,461·78	1·33

DESCRIPTIVE GEOLOGY.

The geological map which accompanies this section of the report adjoins the Cue sheet to the eastward, and includes the western boundary of the grano-diorite belt which is so largely developed in that district.

The line of contact of the grano-diorites with the amphibolites will be seen to run in a north-easterly direction, the former rock covering only a small wedge-shaped area upon the eastern side of the map, whilst the amphibolites occupy the remainder. The main auriferous belt of this district is about 5 miles in length, and has a north-westerly strike lying well within the amphibolite area about 2½ miles to the westward of their main contact with the grano-diorite, whilst the minor belt also exists still within the amphibolite area, but close to the contact zone. The first-mentioned belt is traversed longitudinally by a series of large felsitic dykes, which appears to have played an important part in the formation and enrichment of the reefs.

Recent and Superficial Deposits.—Fully one-half of the area included by the Geological Map is covered by shallow superficial deposits, which have evidently been formed by the gradual disintegration of the rocks *in situ.* These deposits are of little thickness, consisting for the most part of reddish coloured clays, the surface of which is thickly strewn with angular fragments of quartz and ironstone. Over the surface of these, which are fairly level, the wind sweeps with considerable force, carrying with it any loose particles of sand, which are again dropped where an obstacle is encountered, and thus in time form sandhills.

These deposits, which have been mapped in as alluvium for the want of a better term, have so far proved to be of no commercial value, for although, as previously stated, their surface is strewn with large quantities of quartz, this mineral has so far proved to be entirely destitute of gold.

Laterites.—These deposits at the present time only occur as isolated ironstone cappings upon two or three small hills, but in the past they must have been extensive, as their detrital matter is strewn over a very considerable area.

Although these detrital laterites are the only superficial deposits which have proved so far to possess any economic value, it was found impossible to delineate their boundaries upon the map since they consist solely of ironstone fragments, which may e scattered either over the crystalline rocks or clay flats, mer g imperceptibly into true laterites upon the one hand and the allu m upon the other.

One or two shallow dryblowing patches were discovered in is deposit in the early days, from which a limited quantity of d was obtained.

Crystalline Rocks.—Here, like the majority of the goldfields of Western Australia, the superficial deposits rest directly upon the crystalline series, which consist of both acidic and basic rocks traversed by numerous dykes and quartz reefs.

The basic series are the most largely developed, consisting mainly of rocks which may be conveniently classed under the general head of amphibolites, the foliation of which follows a course a little to the west of north with a dip to the eastward **[6910-1]**

The origin of these rocks has not yet been definitely determined, but their general character and chemical composition point rather to their igneous than to their sedimentary origin, and this hypothesis is further supported by the fact that it is much simpler for the pyroxene in the diabase to be altered into hornblende under dynamic metamorphic action than for the sedimentary rocks to be changed by regional metamorphism into crystalline rocks of so uniform a character over so large an area.

On account of the nearness of the water level to the surface the oxidised zone is of very limited extent, but on the other hand the zone in which the influences of hydration have been exercised is considerable, for at a depth of 700 feet in the Victory United mine rocks illustrative of this action are met with. The alteration of the rocks to so great a depth is probably only local, being due to the circulation of the ground waters along the lode fissure which is much faulted and intersected by cross dykes, since these influences have by no means generally affected the rocks of this district, for massive amphibolites are met with in sinking at quite shallow depth in other mines.

In the zone where hydration has taken place the hornblende has been largely altered into chlorite, and sometimes even into chloritic schists, whilst in the oxidised zone these have been further changed into greasy yellow magnesian shales and clays.

The acidic series are represented by the western margin of the large magmatic intrusion of grano-diorite, which lies to the eastward, but since these rocks are of no economic value upon their western edge and have been very fully dealt with in the Cue section of this report, it will be unnecessary to dwell further upon them in this place.

trusive dykes.—In both the amphibolite and granite areas tl rocks are intersected in belts by numerous intrusive dykes, w h may be divided into three classes, one of which is basic and tv lic.

basic dykes, which are mostly epidiorite, are only met with tc the eastern side of the amphibolite area near the contact z which their course is generally more or less parallel.

These are evidently altered diabase rocks in which paramorphic action has taken place, changing the augite, of which traces still remain, into hornblende.

The acidic dykes are of two classes : 1st, those which follow a more or less north-westerly course ; and 2nd, those which follow an erratic course.

The first of these are felsites, occurring as well-defined ridge lines in the auriferous belts, and they have in all probability exercised considerable influence both upon the formation and enrichment of the lodes.

This series of fine-grained felsites can only be examined at the surface where the rock is more or less weathered, and in consequence it is impossible to determine with any degree of certainty their true nature, but to judge from their general character, microscopic structure, and composition, they in all probability belong to the older volcanic series, and may be classed amongst the Rhyolites [**6312**].

The second series of dykes, which are felspar porphyries, are most largely developed upon the range to the westward of the auriferous belt, and are also met with upon the eastern side, close to the contact of the grano-diorite.

These rocks, as a rule, appear to have undergone little alteration, for even when sections have been made from surface specimens they exhibit a perfect crystalline structure. [**6903, 6907**.]

The dykes of this class follow no definite course, but those having a north-easterly direction are of by far the most common, whilst the remainder cross, branch off, and junction, forming an irregular network with them.

In the Victory United mine one of these dykes crosses the lode at the northern extremity of the shoot, but since it cuts clean through the lode it is evidently of later origin [**6909**].

Quartz Reefs and Lodes.—There are two classes of reefs, the first of which are the parallel contacts, which follow a general north-westerly course, and secondly the radiating, which have a more north-easterly course.

The first group lie parallel to, or sometimes even occupy the same fissure as the felsite dykes. These are the most numerous, comprising the Golden Gate, City of Chester, City of Sydney, Black Swan, Fairlight, Lady Rosie, and South Victory reefs, which with the exception of the last two that are situated at the south end of the belt, dip to the eastward.

Upon the eastern margin of the amphibolite area there are a series of small reefs belonging to this class including the Golden Fleece, Treasure Trove, and Kallara, which occur as parallel contacts to the grano-diorite.

The second class of reefs, although by no means so numerous, have so far proved to be the most productive, since they include the Victory United, Rheingold, Blue Bell, and Greymouth, all of which, with the exception of the last-mentioned, dip to the south-east.

Most of the reefs of this district are small, but of high grade, whilst the shoots of stone, if defined at all, are narrow, but so far, with the exception of the Victory United, little work has been done in order to prove their character at a depth.

SECTION IV.—THE MINES OF CUDDINGWARRA.

GENERAL.

Only one mine in the district was accessible at the time of inspection, which was the Victory United, and in this mine only the No. 4 level could be examined, and, as a consequence, the following information has been compiled from all possible official sources added to that most kindly supplied by Mr. Isaac Genge, who has been connected with nearly every mine in the district.

The object of this being to place on record a description as accurate as possible of the nature of the work done upon old abandoned and inaccessible mines, with the amount of stone crushed and gold therefrom, for reference, in case it should be desired to work them again in the future. The various mines described will be found by reference to the Geological Map.

DESCRIPTION OF MINES.

City of Chester, G.M.L. 252 (abandoned).—This is the most northerly lease in the Cuddingwarra district, and lies across the river just outside the two-mile radius from the post office.

There are two lines of reef which both strike north-west and south-east, with an underlay to the north-east.

Upon the western line a vertical two-compartment engine shaft has been sunk to a depth of 120 feet, in which a large supply of salt water was cut at a depth of 15 feet from the surface.

From the bottom of this shaft, a crosscut has been driven west for a distance of 50 feet to the reef, where a level 100 feet in length was driven, which is connected with the surface by two underlying shafts.

The reef with what is called a footwall formation of felspar porphyry [6908] varies from 18 inches to many feet, and has been stoped up from the 120-foot level to the surface.

The eastern reef varies from one to three feet in width, and can be traced for a distance of 30 chains south from a quartz blow; it appears to follow a dyke like the western reef, two feet of which, in a weathered condition, is visible upon the footwall side in an open cut.

It has been opened up by four underlay shafts, the deepest of which is 120 feet, with a level from the bottom of 200 feet in length. There is also a level at 40 feet below the surface, from which stopes have been carried up to the open cut.

The country for the most part is solid amphibolite, but certain schistose portions met with in sinking rendered close timbering necessary.

There has been a crushing mill, cyaniding plant, winding engine, and pumps upon this mine, but these have all been removed as the mine has been abandoned for five years.

Table showing the Yield of the City of Chester Reef.

Year.	Name and Number of Lease.	Ore crushed.	Gold therefrom.	Rate per ton.
		tons.	ozs.	ozs.
1897	City of Chester G.M.L. 252 ...	116·00	100·00	·86
1898	Do. do. ...	203·00	117·77	·56
1900	Do. do. ...	90·00	32·85	·36
1901	Do. do. ...	950·00	794·12	·83
	Total	**1,359·00**	**1,045·44**	**·77**

City of Sydney, G.M.L. 1235 (abandoned).—This mine is the northernmost of the town group, and situated about half a mile north-east of the post office.

The reef has a course north-west, with a dip of between 60 and 70 degrees to the westward.

A vertical shaft has been sunk to a depth of 70 feet, and the reef, which varies from a few inches to several feet in thickness, has been driven on for a length of 80 feet, and stoped to the surface, the only record of any crushing being in 1900, when 95 tons yielded 86 ounces of fine gold. The country appears to be hard amphibolite below the water level, which is 15 feet below the surf and extremely salt.

Blue Bell, G.M.Ls. 846, 748 (abandoned).—This old mine between the City of Sydney and the town; it was worked in very early days, even at the time of Mr. Goezel's visit in 1894, states that a certain amount of work had been done, and that tons of stone were at grass awaiting treatment.

This reef strikes in a north-east direction, dipping to the south-east at an angle of 42 degrees, and varies in size from 6 inches to 4 feet, with an average of 18 inches.

There is a large supply of salt water, which now stands at 15 feet from the surface, but this water level at the time of Mr. Goczel's visit was 26 feet, at which level the reef has been driven on for a length of 300 feet, above which most of the stone has been stoped to the surface.

Close to the southern boundary of G.M.L. 846 a main vertical engine shaft has been sunk to a depth of 120 feet, from which a crosscut has been driven to the westward 130 feet, when a number of quartz leaders were cut, but no defined reef.

In the southern lease there are a number of reefs, or spurs off a main fissure, which terminate in a blow at the south end, and upon these a considerable quantity of work has been done to a shallow depth. There appears to have been only one parcel of stone crushed since records were kept, this was 72 tons in 1899, which yielded about 16 ounces of gold ; all previous records appear to have been lost.

Blue Bell Proprietary, Ltd., 925, *etc.* (abandoned).—This company owned a number of leases known as the Blue Bell and W.A. blocks; they occupied all the spare ground between the Golden Gate and the Victory United and Blue Bell leases.

A considerable amount of shaft sinking and trenching has been done, but there is only a record of 84 tons of stone being crushed, which yielded 22 ounces ; later on there is a footnote stating that 220 ounces were reported, but the quantity of stone crushed omitted.

The Venus, G.M.L. 1268 *and Whisper Low, G.M.L.* 1491 were both parts of this area after its abandonment by the company, the recent owners only scratching out a little stone from the old workings, only 21 tons of which were crushed, from which about 19 ounces of gold were obtained, while 14½ ounces were obtained by dollying.

Fairlight, or Laura, G.M.L. 386 (abandoned).—This lease was situated to the southward of the Blue Bell, and upon it a small reef with a north and south course, varying from one to two feet in thickness, was opened up by two underlay shafts and a vertical one 80 feet in depth, at the bottom of which there is a d[illegible]e 30 feet in length.

Two crushings are reported from this reef, one in 1897 and t[illegible]ther in 1899, the total from which was 280 tons, which yielded 9[illegible] ounces of fine gold.

olden Gate, G.M.L. 634, *etc.* (abandoned). Plate XIV.—[illegible] mine was situated upon a main felsite dyke [6912 which s[illegible]es in a north-westerly direction, lying about half a mile to t[illegible]ward of the town.

It consisted of three leases, which were worked between 1897 and 1901 by a company known as the Cuddingwarra Gold Mines, Ltd., which company did a considerable amount of work consisting of a main vertical shaft 190 feet, with a drive at the 110-feet level for a distance of 425 feet north and 265 feet south.

There are also a number of short levels at a depth of 40 feet below the surface (which was just above the water level), above which a good deal of stoping was done up to the surface, where the cap of the reef has been removed for a length of 300 feet.

In the 110-feet level there appear to be two shoots. The one where the crosscut from the main shaft cut the lode is 120 feet in length, whilst about 50 feet farther north there is another which is 80 feet in length. Both of these shoots have been stoped up to the 40 feet level, the stone, which averaged about 3 feet in thickness, was contained in a broken formation (dyke ?).

The water is very salt, and is now standing at a depth of 18 feet below the surface.

This company had a Krupp ball mill on this mine, with a Cornish lift and winding plant.

Later on this mine passed into the hands of the Fingall Proprietary, Ltd., who did little with it, whilst during the years 1904 and 1905 it was worked under the name of the Scotia, when a battery was placed upon it.

Table showing the Yield of the Golden Gate Reef.

Year.	Name and Number of Lease.	Ore crushed.	Gold therefrom.	Rate per ton.
		tons.	Ozs.	Ozs.
Prior to 1897	Golden Gate G.M.L. 634	238 00	118·56	·49
1897	Cuddingwarra G.M., Ltd., 634, etc.	77·00	42·07	·54
1898	Do. do. ...	3,351·50	1,978·62	·59
1899	Do. do. ...	667·00	980·71	1·47
1900	Do. do. ...	100·00	986·15	9·86
1901	Do. do. ...	...	...	...
1902	Fingall Proprietary, Ltd. ...	85·00	32·95	·38
1903	Do. do. ...	172·00	124·33	·72
1904	Scotia G.M.L. 1440 ...	80·00	47·90	·59
1905	Do. do. ...	852·00	225·77	26
	Total	**6,722·50**	**4,537·00**	**67**

Victory United, G.M.L. 595, 1122 (Plate XV.).—This min is situated about half a-mile to the township of Cuddingwarra, ar it has been worked continuously since the discovery of this field.

It was originally held by two companies, the one which owned most of the outcrop being called the Fortune of War, whilst the one into whose property the shoot dipped was called the Victory United. In the year 1898, these two companies were amalgamated, and they also acquired the Rheingold, a property lying a little farther to the southward, when these were worked in conjunction, the returns being bulked up to 1901, after which the Rheingold property was thrown up and only the Victory United reef was worked. The reef has a north-easterly course dipping at a high angle to the south-eastward, with an outcrop of 210 feet at the surface, the whole of the stone from which has been stoped out.

Most of the early workings were carried on from shallow surface shafts, but later on the company sunk a main vertical shaft to the eastward, which is now down 700 feet.

Judging from the plans of the workings a well defined shoot of stone existed which has a decided northerly dip, but appears to decrease slightly in length with depth, but still carries very good values.

In the No. 4 (600 feet) level the vein, where cut, starts abruptly from a cross felspar porphyry dyke [6909], whilst at the southern end of the shoot it is cut off by a diagonal fault which displaces the vein. About 100 feet to the southward of this fault a small rich bunch of stone was cut, which was risen on when it proved payable for a distance of 30 feet. Southward of this the reef is again faulted and broken, but the fissure should be easily picked up by cross-cutting at the face.

The main rich shoot has been followed by a winze from this level for 100 feet, in which it proved to be of good value and is a well defined body of stone.

The main shaft encountered the porphyritic dyke, but near the lode a considerable quantity of crushed country was met with which rendered sinking very difficult.

In this mine the reef has averaged about 2 feet in thickness, but although small, its value of over 1½ ounces has made it pay we[illegible]; it is a nice looking mineralised stone containing a little copper, le[illegible], and zinc in the form of sulphides, which pay well to conce[illegible]ate.

The plant for the most part is old, but a large new compressor ha[illegible] recently been added, also two boilers, one Lancashire and one B[illegible]ock's, the latter proving to be practically valueless, since the fe[illegible]water contains too large a percentage of salts.

Table showing the Yield of the Victory United Reef.

Year.	Name and Number of Lease.		Ore crushed.	Gold therefrom.	Rate per ton.
			tons.	ozs.	ozs.
Prior to 1897	Fortune of War	G.M.L. 95	1,580·00	1,368·42	·86
1897	Do.	do.	651·00	672·96	1·03
Prior to 1897	Victory United	G M.L 595	2,272·00	4,798·83	2·11
1897	Do.	do.	701·00	1,545·16	2·20
1898	Do.	G.M.L. 595, 1122 & 671	1,854·00	2,903·18	1·56
1899	Do	do.	1670·00	4,775·05	2·85
1900	Do.	do.	485·00	1,906·08	3·93
1901	Do.	do.	430·00	424·00	·99
1902	Do.	G.M.L. 595 & 1122	143·00	385·44	2·76
1903	Do.	do.	140·00	470·98	3·36
1904	Do.	do.	1,426·00	1,508·09	1·05
1905	Do.	do.	2,558·00	2,533·16	·99
1906	Do.	do.	2,777·00	3,578·77	1·28
	Total		**16,687·00**	**26,870·12**	**1·61**

Black Swan, G.M.L. 867 (abandoned).—This is an old lease upon the salt flat to the southward of the Golden Gate ; it has not been worked since 1897, when 60 tons of stone were raised which yielded 9.15 ounces of gold.

Greymouth, G.M.L. 968 (abandoned).—This lies a little to the south-westward of the last-mentioned, upon a reef which strikes south-westerly from the main dyke ridge.

A number of shafts have been sunk, mostly upon the underlay to the westward, but one vertical has been sunk to a depth of 120 feet, in which the water level was 15 feet below the surface.

During the years 1897 and those preceding it, 170 tons of stone were crushed from this mine which yielded 445½ ounces of fine gold.

Rheingold, G.M.Ls. 671, 726 (abandoned).—This is a north-easterly and south-westerly reef, which lies about half a-mile south of the Victory United.

Upon this lode, which underlays to the south-eastward a ver considerable amount of work has been done, first by the prospectors and then, after 1897, by the Victory United Company until 1901 when it was abandoned, but was taken up again by a working part and held during 1904 and 1905.

A main three-compartment vertical winding shaft was sunk t a depth of 120 feet, and a crosscut driven 160 feet at the 90 fo level to the lode, which is here from 18 inches to 4 feet in thickness. There are several shafts down to 40 feet with two levels, each driven 100 feet in length, above which stopes have been carried up to a height of 30 feet, the stone varying from 2 inches to 10 feet.

The water, which is salt, and is in considerable quantity, is now standing at 20 feet from the surface.

Table showing the Yield of the Rheingold Reef.

Year.	Name and Number of Lease.	Ore crushed.	Gold therefrom.	Rate per ton.
		tons.	Ozs.	Ozs.
Prior to 1897	Rheingold G.M.L. 671 and 726	108·00	106·79	·98
1897	Do. do. ...	225·00	235·97	1·04
1898	Returns included in those of the Victory United			
1899				
1900				
1901				
1902				
1903				
1904	Rheingold G.M.L. 1420 ...	55·00	48·65	·88
1905	Do. do ...	42·00	20·89	·49
	Total	**430·00**	**412·30**	**·95**

Bonanza, G.M.L. 1055 (abandoned).—This old mine is situated upon the main road between Cuddingwarra and Day Dawn, about 1½ miles south of the former township.

The reef has a north-east and south-west strike, with an underlay to the south-east, upon which a vertical shaft was sunk to a depth of 42 feet, with a drive 15 feet, from which a stope was carried up to an open cut at the surface in which the stone averaged about 18 inches, of which 42 tons were crushed prior to the year 1897, which is reported to have yielded 38 ounces of fine gold.

The water supply was very heavy, and in consequence further sinking could not be carried on without the aid of machinery.

Lady Rosie, G.M.L. 790 (abandoned).—This old mine, which is situated about half a mile to the southward of the last-mentioned been worked off and on under various names from 1896 to 1905.

The reef has a general north and south course, with an under- o westward, and is from 6 inches to 2 feet in thickness. Upon considerable quantity of work has been done. A main vertical ompartment winding shaft has been sunk to a depth of 120 when the reef was driven on for a length of 100 feet; the water, s salt, now stands in this shaft up to the 40 feet level.

Table showing the Yield of the Rose Reef.

Year.	Name and Number of Lease.	Ore crushed.	Gold therefrom.	Rat per to
		tons.	ozs.	ozs.
Prior to 1897	Lady Rosie G.M.L. 790 ...	85·00	87 79	1·
1897	Do. do. ...	90·00	95·44	1·
1898	Do. do. ...	100·00	58·37	·
1900	Amy Florence G.M.L. 1166	176·00	221·44	1·
1900	Rose G.M.L. 38	10·00	2·65	·
1903	Royal Mint G.M.L. 1376 ...	141·00	106 32	·
1904	Do. G.M.L. 1422 ...	265·00	160·25	·
1905	Do. do. ...	22·00	19·29	·
	Total	**889·00**	**751·55**	

South Victory, G.M.L. 1364.—This is situated about 20 chai
south of the last-mentioned ; it is a large reef, striking north a
south, and dips at a high angle to the westward. Two shallow u
derlay shafts have been sunk, and two vertically to the reef, fr
which 58 tons of stone have been crushed, which yielded 53¾ oun
of gold.

Golden Fleece, now Emily, G.M.L. 1510.—This mine is abo
2½ miles in a north-easterly direction from Cuddingwarra, ne
the contact zone of the amphibolites with the grano-diorites, it h
been worked in an intermittent manner under various names sir
1896.

There are two reefs upon this lease, one the main Golden Fle
reef has a north-easterly course, dipping to the eastward; it h
been worked from the surface by an open cut and underlay sha
whilst a vertical shaft has been sunk to cut it to the dip.

The southern reef has a more east and west course with a d
of 40 degrees south, and it appears to be a lenticular body.

An old shaft has been sunk on it to a depth of 90 feet, a
the reef driven on to the westward, when it became small in t
face. Stopes were carried up from this level to within 30 feet
the surface. A new vertical shaft is being sunk at the west e
of this reef with the idea of testing it at its junction with the Fle
lode.

Table showing the Yield of the Golden Fleece Reef.

Year.	Name and Number of Lease.	Ore crushed.	Gold therefrom.	Ra per t
		tons.	Ozs.	Ozs
Prior to 1897	Golden Fleece G.M.L. 873	84·00	58·83	
1898	Windmill, G.M.L. 1120 ...	127·25	63·23	
1899	Oxonian, G.M.L. 1146 ...	151·00	188 05	1
1900	Do. do. ...	23·00	31·72	1
1905	Emily G.M.L. 1510 ...	6·00	7·77	1
1906	Do. do. ...	70·50	82·72	1
	Total	**461·75**	**432·32**	

Treasure Trove, G.M.L. 874, 836.—This lies about a mile south of the Fleece, and upon these a considerable amount of work was done in the early days by the Anglo-W.A. General Exploration, Limited.

There is no defined reef but a series of veins which follow a more or less north and south course parallel to the contact and dipping east towards the granite.

There is only a record of one crushing in which 74 tons of stone are stated to have yielded 55 ounces of fine gold.

IN CONCLUSION.

It will be seen from the foregoing that only a partial record can be obtained of the production of this district, and only an authentic one for the last 10 years, during which period mining has not been brisk in this locality, but it will be noticed that in general the returns are high, and that prospecting is almost impossible for working miners without capital in face of the large quantity of water they have to contend with, therefore, it is to be hoped that the compilation of these particulars, meagre and unsatisfactory as they are, may have the result of directing attention to a district which, in spite of the fact that the stone is rich, has never attracted it because it is off the beaten track.

Index at the end of Part II.

By Authority: Fred. Wm. Simpson, Government Printer, Perth.

LIBRARY
OF THE
UNIVERSITY
OF
CALIFORNIA

BULLETIN NO 29 PLATE XII
PART 1.

G. M.

LIBRARY
OF THE
UNIVERSITY
OF
CALIFORNIA

BULLETIN Nº 29 PLATE XIV.
PART 1.

LIBRARY OF THE UNIVERSITY OF CALIFORNIA

LIBRARY OF THE UNIVERSITY OF CALIFORNIA

1908

1907.

WESTERN AUSTRALIA.

GEOLOGICAL SURVEY.

BULLETIN No. 29.

A Report upon the Geology, together with a Description of the Productive Mines

OF THE

CUE AND DAY DAWN DISTRICTS,

MURCHISON GOLDFIELD.

PART II.

DAY DAWN CENTRE.

BY

HARRY P. WOODWARD,
Assistant Government Geologist.

Issued under the authority of the Hon. H. Gregory, M.L.A.,
Minister for Mines.

WITH TWO MAPS AND 8 PLATES OF SECTIONS.

LIBRARY
OF THE
UNIVERSITY
OF
CALIFORNIA

PERTH:
BY AUTHORITY: FRED. WM. SIMPSON, GOVERNMENT PRINTER.

1907.

These lodes for the most part lie in a series of more or less parallel lines along the centre of the area, having with one or two exceptions a general northerly course with a dip to the westward or following the cleavage planes of the schist (the fissure planes or planes of greatest weakness being coincident with the foliation), thus giving them the appearance of bedded veins.

They are of that type which has been badly distinguished by the extremely vague and inappropriate designation of true fissure veins, which term, strictly speaking, embraces all classes of fissure lodes, therefore the term of faulted fissure is much more applicable to them as indicating that a differential movement has either taken place between the walls themselves or between one or even both, and the lode matter.

The fissures in this district are for the most part either faults or shearing planes, although instances of both joint and fissility veins also occur, but in most cases however they are probably fault fissures owing to their great longitudinal extent and the indications of grinding met with upon the wall. These fissures, which allowed the circulating of underground waters charged with mineral matter to deposit silica layer by layer upon their walls, appear to have opened gradually owing either to the shrinkage of the adjoining rocks or by the sliding of the irregular walls before referred to by which, when concave surface was opposed to concave more or less lenticular-shaped spaces or pipes would be formed through which the depositing solutions could flow with greater ease. That these fissures opened gradually is proved by the presence of rock masses (called horses) enclosed in the lode matter, for had the fissure been suddenly opened to their full extent these detached rocks would have fallen until they became jammed between the walls at a narrow point and would therefore be in touch with both sides, whereas they are generally entirely surrounded by quartz thus proving that they become detached from one of the walls by a dislocating force after the other side had been cemented to the opposite wall.

In some instances these fissures have been expanded by the bending or buckling of the rocks due to elongation, and it is at these points that quartz bodies usually attain their maximum dimensions.

Many quartz reefs in the district are found to have well-defined outcrops traceable at the surface for a considerable distance, whilst upon development at lower levels they are often found to consist of a series of lenticular masses; in other cases there are isolated outcrops following a general line of strike and these latter may possibly be found to be one continuous body at a depth; in
instance however their formation is due to the unequal openi
the fissure. This question of continuity of line is usually consi
to be of great importance, particularly if by any stretch of ima
tion it can be claimed that a reef is upon the same line as
mine. In reality however, the only point of value in continuo
ures is that the greater their longitudinal extent the mor

there is of their living downwards. When, however, it is a question of values the length of a fissure is of little consequence, for although it may be undoubtedly proved that a series of quartz bodies occupy the same fissure, one of which is rich, it is in this State most generally found that the others are poor or barren since the gold is usually localised in lodes in the form of bunches or pipe-like portions called shoots, the deposition of which is governed by some law which has not yet been discovered.

The lodes of this district may be divided into three groups, 1st, those of the igneous zone, 2nd, those of the contact zone, and 3rd, those of the amphibolite zone.

In the igneous area the reefs appear to occupy faulted fissures which have a general trend north and south with a dip to the westward; they often bifurcate and are not so regular in their course as those met with in the more foliated country, neither are the quartz bodies of such length although the fissures may be of considerable extent. The returns from 22 leases worked in this region show a total of 6,389.84 ounces of fine gold, being .82 per cent. of the production of the district, therefore so far this has not proved to be a very productive zone.

No mine in this area has yet proved to carry payable stone much below the water level (about 100 feet), but since with the exception of the Rubicon, little work has been done below it, the question as to whether this is a general rule has not been conclusively demonstrated.

In the Rubicon mine, a zone of enrichment was worked from the surface down at and near a point where the reef bifurcates to a vertical depth of 144 feet, below which although the lode has been followed to a depth of 900 feet and driven on for a considerable length both north and south no further payable stone has been cut.

The fissure in this mine is of considerable width, the whole being sometimes occupied by crushed rock material called formation which in places contains strings, veins, and bunches of quartz, or the whole channel may be filled with that material. The walls of this lode are sometimes highly polished and striated, whilst at others they are ragged, but judging from its general character it is evidently a fault fissure, and therefore the vein may continue to a considerable depth.

The richest reef in this line is the Crœsus, which from 1,138 tons of stone yielded 1,640 ounces of fine gold, this being apparently exclusive of the sands treatment of which tl re is no record. All this stone was raised from above the 100 f t (water) level, but as the mine has not been worked since 1899 it inaccessible, and in consequence the character of the lode cannot b lescribed.

A number of reefs from which small returns have been obtained li outh of the last-mentioned, also to the westward of the Trenton H whilst at the south-west corner of the map in the Mount Fingall, late Strathmore, there appears to be a fissure of considerable promise.

The second group occupying the contact zone contains all the principal productive mines of the district, but strange to say there are only eight gold-bearing reefs in it, these, however, or more correctly three of them, have produced 97.60 per cent. of the total yield of the district.

These reefs, generally speaking, have a more decidedly north-westerly course than the last group and underlay to the south-west, the exceptions being the Day Dawn West and the White Horse, which appear to be joint fissures with a strike to the north-east and dip to the south-east. All the lodes in this as in the other groups appear to follow the cleavage plains of the schists, but since there is a very considerable variation in their course even when in close proximity, this foliation in some instances must be local and due to the shearing action which has taken place parallel to the fissure planes.

There is one point worthy of note with regard to the zone of greatest enrichment in this group of mines, which is that it occurs in the reefs at a point which varies from 10 to 15 chains distant from the boundary of the igneous rocks, whilst in the reefs having a normal course the shoot dips towards them.

Two reefs belonging to this series, viz., the Great Fingall and the Golden Crown, can be traced at the surface penetrating the igneous zone in which they either bifurcate or follow an irregular course. This is clearly seen at the north end of the Great Fingall where a split occurs in the vein, one branch maintaining the general course in an irregular manner whilst the other first turns sharply to the northward along the contact for a short distance and then strikes off the igneous region. This bifurcation is also met with in each succeeding level in this mine beyond which point the course of the vein is generally irregular ; it carries low values for a distance and then generally pinches out. Although the parallel foliation of the rocks due to shearing are apparently continuous along the fissure a change in their nature may be observed, particularly near the contact where they become graphitic.

It is probable that the bulges which often occur in this series of reefs are due to a certain amount of buckling which has taken place in this area due to pressure being exercised upon the ends of the foliated rocks.

The third group which are situated in the amphibolite area is of the usual normal type possessing a general northerly strike westerly dip, and although the statistics show that the return f 22 leases amount only to 1.26 per cent. of the total production the district it is quite possible that some of these may develop good mines.

There are only two mines in this group upon which what ca called development has taken place, these being the East Fingal the Kinsella, the former of which has cut the Eureka No. 5 at the 500-feet level. This point is of very great importance as demonstrating clearly that these reefs although they may lose values at points in their descent still recover again and contain bodies of payable ore at depths considerably below the water level which was previously supposed to be their limit.

To the southward of the East Fingall, a certain amount of local disturbance has taken place which is possibly due to the intrusion of andesite dykes, one of which was met with in the Creme d' Or mine.

The Kinsella which lies farther to the south-east has a north-easterly course and dips to the south-eastward at a high angle ; it is a well-defined fissure line, the lode being of great size in places, but it is generally speaking of low grade.

SECTION II.—THE MINES.

GENERAL.

This section is devoted to a more or less detailed description of the individual mines of this district, but in it notice has only been taken of those which have been productive.

Upon the whole a very inconsiderable amount of work has been done upon the majority, only about ten being in any way entitled to be called mines since development has been confined for the most part to the wholesale removal of stone above the water level.

Out of those which may be classed as mines, only two are completely equipped, and only one at the present time, viz., the Great Fingall, is worked at a profit, whilst this latter is worked upon so large a scale as to cast a very considerable shadow over the joint production from all other sources.

It naturally follows that the name "Fingall' in some form is very popular, whilst reefs at distant points and in impossible positions are described as being the continuation of the famous lode. Unfortunately, so far we have only one Great Fingall in the district, but when the fact is borne in mind that this was once only the Day Dawn mine with a very limited, and later on worked out, shoot of stone, and that the existing ore body was only discovered through the enterprise of the present company, it follows that in a district where so little solid prospecting has as yet been undertaken, it is quite possible for other bodies of equal or even greater value to lie hidden beneath the surface.

The following is a table compiled from official sources giving the amount of stone crushed with the gold therefrom in fine ounces, as reported to the Mines Department by each company or party holding the various areas, from which it will be seen that the stone from this district has averaged 0.92 ozs. per ton.

The difficulties and high cost of working here on account of the scarcity of timber and fuel being the same as at Cue, referred to in Part I., it will not be repeated here.

Table showing the Production of the Leases in the Day D District.

Name of Lease.	Number of Lease.	Ore Crushed.	Gold therefrom.
		Tons.	Ozs.
Ada Mary	278D	66.00	34.09
Aurifer	253D	11.00	2.74
Bonnie Scotland	215D	6.50	13.10
Caledonia	350D	..	12.51
Cooya	28D	85.00	51.41
Creme d'Or	389D	398.00	300.68
Crœsus	14	1,138.00	1,640.41
Cue Mining and Exploration Co., Ltd.	233D etc.	2,064.00	635.15
Day Dawn	398D	90.00	258.59
East Fingall	264D	1,208.00	709.19
Edward VII.	214D	30.00	88.33
Emperor	176D	1,849.70	2,874.76
Eureka No. 5	26D	1,280.25	1,292.49
Fingall	239D	50.00	22.17
Golden Crown	78D	110.00	130.58
Great Fingall Associated ..	332D	30.00	4.00
Great Fingall Consolidated, Ltd.	1D etc.	804,851.00	749,456.52
Great Western	125D	43.00	25.99
Groper	156D	172.00	158.70
Ironclad	413D	47.00	4.33
Ironclad North	412D	50.00	36.22
Ivy Mary	327D	23.00	1.34
King Edward VII. ..	322D	54.00	42.16
Kinsella	149D	10,801.00	4,348.91
Klondyke	312D	93.50	31.58
Klondyke	293D	98.00	42.25
Last Chance	369D	111.00	41.93
Mikado	179D	28.50	19.54
Mount Fingall	273D	1,809.00	1,042.71
Murchison Associated Gold Mines, Ltd.	138D etc.	3,503.50	2,216.61
New Ballarat	394D	124.00	116.90
New Caledonia	157D	155.00	85.99
New Fingall	331D	17.00	9.56
Nimrod	M.L. 1	30.00	37.33
Pelican	101D	25.00	26.59
Perseverance	46D	48.50	35.04
Phœnix	173D	40.00	607.76
Queen's Birthday	66D	33.00	7.33
Revenue	282D	20.00	3.79
Richmond	151D	70.00	182.78
Royal Charter	181D	317.00	322.04
Sailor Lad	134D	48.00	53.59
Smith's United	146D	162.00	261.24
Southdown	115D	429.00	636.74
St. Albans	119D	43.00	15.33
Strathmore	163D	47.00	26.73
Trenton	148D	8,746.10	6,197.98
Try Again	267D	49.25	79.61
Welcome	307D	50.00	28.43
West Fingall, No. 6 ..	119D	43.00	15.32
White Horse	268D	5.00	5.14
Yalgoo Proprietary Prospecting Syndicate, Ltd.	12D	720.00	806.22
Sundry Claims	..	588.25	725.08
Day Dawn South Battery ..	3D	380.00	505.50
Cue Victory Battery ..	..	..	21.50
Day Dawn Public Battery ..	M.A. 6D	125.00	1,049.22
Emperor Battery	..	30.25	15.77
Eureka No. 5 Battery ..	..	264.50	128.67
	..	844,023.05	778,606.20

T. T. RHYS, Photo.

DESCRIPTION OF THE MINES.

The Great Fingall Consolidated, Ltd.—This property, which is situated upon a spur on the western side of the large alluvial flat immediately adjoining the southern boundary of the town of Day Dawn, consists of a large group of leases, amongst which are embraced the old Day Dawn, the Day Dawn North, the Day Dawn South mines, now worked as the Great Fingall; also the Day Dawn West, the Pelican, the Golden Crown, the St. Albans, and the Smith's United Mines (at present idle), which, together with a number of other leases are held for block or area purposes. (Photo. 1.)

At the present time only the principal mine is being worked, this is the original Day Dawn, which gave its name to the town; it was discovered in the year 1891 by Mr. Heffernan, but later on passed into the hands of the Consolidated Murchison Gold Mines, Ltd., by whom it was worked until 1899, when the abandonment of the mine was seriously meditated ; fortunately, however, the Great Fingall Company, which was strong financially, decided to give it a further trial, and the result of this enterprise was rewarded by the discovery of a large and rich shoot of gold from the proceeds of which they have been enabled to pay their shareholders close upon one and a-half million pounds in dividends, to equip the mine with a thoroughly up-to-date plant and to acquire property of considerable value.

Up to the end of the year 1906, this mine, exclusive of the West Day Dawn (the returns from which mine are included in the official statistics), produced 795,077 tons of stone, which yielded 742,612.95 ounces of fine gold, or at the rate of 0.93 ounces per ton, being 95.38 per cent. of the total gold production of the district.

As previously stated, the lode lies within, or more correctly speaking crosses, the contact zone, its course starting from the south end, being first west-north-west, then north-west, and then north-north-west until it bifurcates when the western branch follows a course a little west of north, and the eastern, after first taking a sharp turn to the north-east for a short distance assumes a nearly north and south course with a slight inclination to the eastward at the north end.

This reef, which has an outcrop of about 30 chains in length, was of considerable size at the surface and rose above the level in a series of camel-backed ridges from 10 to 20 feet in height. The first at the south end rises from the alluvial flat and was originally held as the Day Dawn South; the next or main outcrop from a low schistose slope was the Day Dawn, whilst a long ridge with two slightly higher points was the Day Dawn North.

Beyond the point where the reef splits, which was originally known as the Union Jack, the character of the outcropping rock changes, the surface being strewn with pieces of rock of a more massive character into which the western spur penetrates and can be seen at the surface for a distance of about 10 chains, whilst the eastern, after it has assumed a northerly course, outcrops as a bold ridge for some distance, but gradually becomes less conspicuous until it can only be traced by strewn quartz boulders, the total length of this branch being about 20 chains, after which all indication of it is lost. It is quite possible, however, that this is a main fissure line extending northward, but on account of it not containing quartz it cannot be followed at the surface.

The south end of the main lode rises abruptly out of the alluvium, consequently the southward extension of the reef is not visible in this direction, but the fissure most probably swings round on to a more southerly course, following the main foliation of the rocks. A considerable amount of boring has been done some twenty chains farther south, but no prospecting has been done from the surface at the point of disappearance in order to test this question.

The average dip of the vein is 60 degrees, and the general character of the outcropping quartz is a dense blue grey or blackish banded stone showing traces of the presence of pyrites by lines of red iron oxide, whilst the enclosing country varies from a brownish highly-weathered schist to chloritic schist and epidote rock, which, as before stated, at the northern end it is replaced by a massive hornblende rock.

In the under workings the reef has not that continuity in a northward direction which is apparent at the surface, although to judge from the plan it must have been fairly so in the No. 1 level (not accessible), whilst a branch drive to the northward appears to indicate that the eastern arm was followed for a short distance in that direction.

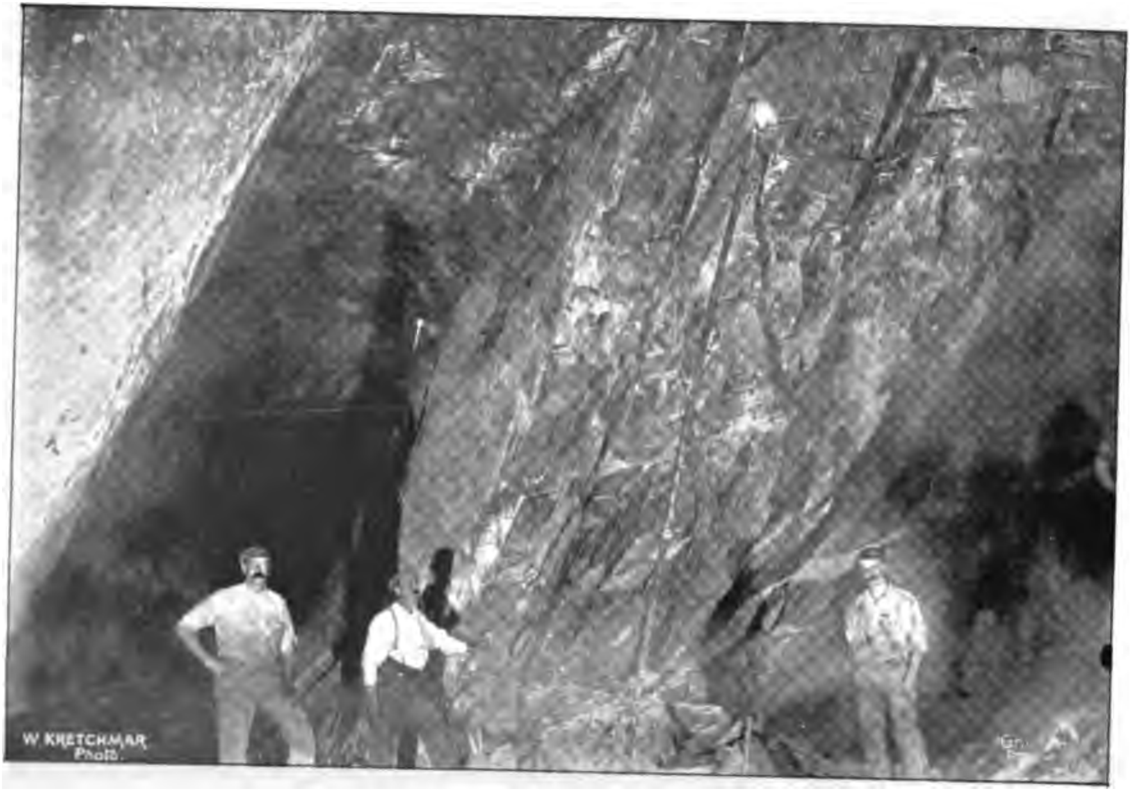
Below the No. 1 level little northward exploitation has taken place until the No. 7 was reached, in which the reef was followed northward on a strong and rich quartz body from the crosscut to Armstrong's shaft for a distance of 300 feet, just beyond which point it is suddenly lost. More recently, however, when the eastern or footwall branch of the reef was risen on from the levels below it proved to exist upon the western side of the drive.

This level has recently been extended for a distance of over 1,000 feet, or to beneath the old Union Jack workings, in schistose country, and therefore along the line of fissure with quartz veins here and there sometimes for a considerable distance, but of small size and low value.

From this level about 500 feet of cross-cutting has been done, in which several veins of quartz were cut, but which proved to be of little value; in the crosscut at the north end a good sized body of stone has been cut, which is clearly the eastern branch of the lode, as it corresponds in position, etc., with the vein prospected in the 300-feet levels above from the Union Jack shaft.

In the next three levels at a position below the point where the ef was lost in the No. 7, the vein splits, but this was not at first overed, as no quartz followed the eastern or footwall branch at

PHOTO. 2.



W. KRETCHMAR Photo.

Horse in Lode.

LIBRARY
OF THE
UNIVERSITY
OF
CALIFORNIA

the point of bifurcation. Some 200 feet farther on in the No. 9, a vein united with it upon the footwall side, which was then followed back to the point at which the lode split, thus enclosing a large horse of country.

In the Nos. 8 and 10 levels this has not been traced round, as the quartz was of too low a grade to be considered worth following. In the levels below this the reef bifurcates, but both branches become small and of low value in this direction.

Towards the ends of these levels a crushed rock consisting largely of graphite and chlorite is often met with, which appears to indicate the contact line between the schists and the diabasic rock; little change, however, can be noticed in the rocks themselves, since the levels have followed the fissure, along which they have been altered and foliated in planes parallel to it, the best indication of the change of country being found in the character of the fissure itself, which from the surface downwards to the lowest levels splits at the northern end of the shoot, and from this point onwards assumes the character peculiar to a vein in massive rock.

At the south end of the various levels the reef becomes small and gradually pinches out, but with the exception of the No. 5 level practically no prospecting has been carried on in this direction; in this level, however, the drive has been extended to about 600 feet beyond the point where the vein was lost, which is a little beyond the No. 10 rise.

Near this point a well defined fissure, from which a considerable quantity of water is emitted, may be noticed striking off to the southward, after passing which the country becomes dry, and the rocks more magnesian in character, whilst their cleavage planes cross the drive at an angle from which it is apparent that the fissure has been lost, it having turned off to the southward at the point from which the water flowed.

At a point a little below the No. 5 level near Armstrong's shaft the lode is joined diagonally by a spur upon the footwall side which is called the New Reef and proved to carry good values for a length of 150 feet, whilst the main reef which was almost barren above the union became very rich below it.

This is a point to which very considerable interest attaches in this mine owing to the fact that the shoot of gold worked by the original Company, which was the only one that outcropped at the surface, terminated at a vertical depth of about 150 feet, thus leaving 100 to 150 feet of nearly barren ground between it and the top of the main shoot.

Below the surface this lode presents all the characteristics of a faulted fissure, being possessed of good walls which at many points are polished and striated, being often separated from the adjacent country rock by a layer of clay, thus clearly demonstrating that considerable movement with accompanying grinding action has taken place. In places large masses of the rock have become detached and subsequently enclosed in lode matter thus forming horses (Photo. 2) whilst at other points vugs or cavities lined with crystals are also met with in the vein itself.

Below the water level, which is about 150 feet in vertical depth from the surface, the reef becomes mineralised containing small quantities of pyrites, pyrotite, arsenical pyrites, blend, galena, and copper.

The reef has a very uniform dip of 60 degrees to the south-westward and is generally of considerable thickness, bulging for a considerable length in the main shoot to a width of from 30 to 40 feet; at the ends however, it pinches away to mere stringers an threads beyond which nothing but the fissure line remains. This great swelling in the width of the fissure is in all probability due to the buckling of rocks owing to longitudinal pressure.

The pay ore in this mine occurs in limited but defined sections or shoots of considerable size separated by zones of poorer or barren ground. These shoots do not follow the fissure plane down upon its full dip but traverse it diagonally more to the northward; they occur at those points where the vein attains its maximum proportion. The main shoot varies from 6 to 40 feet in thickness with an average width of 600 feet, and has a proved continuous downwards extension from the No. 4 to the No. 13 level, or a length upon the lode plane of 1,500 feet.

Besides the main shoot there is a second one farther south which has been stoped from the No. 5 to the No. 10 level for an average width of about 300 feet, it is neither so large nor so rich as the last mentioned from which it is divided by a poorer zone about 150 feet in width, but a good deal of this will probably be worked.

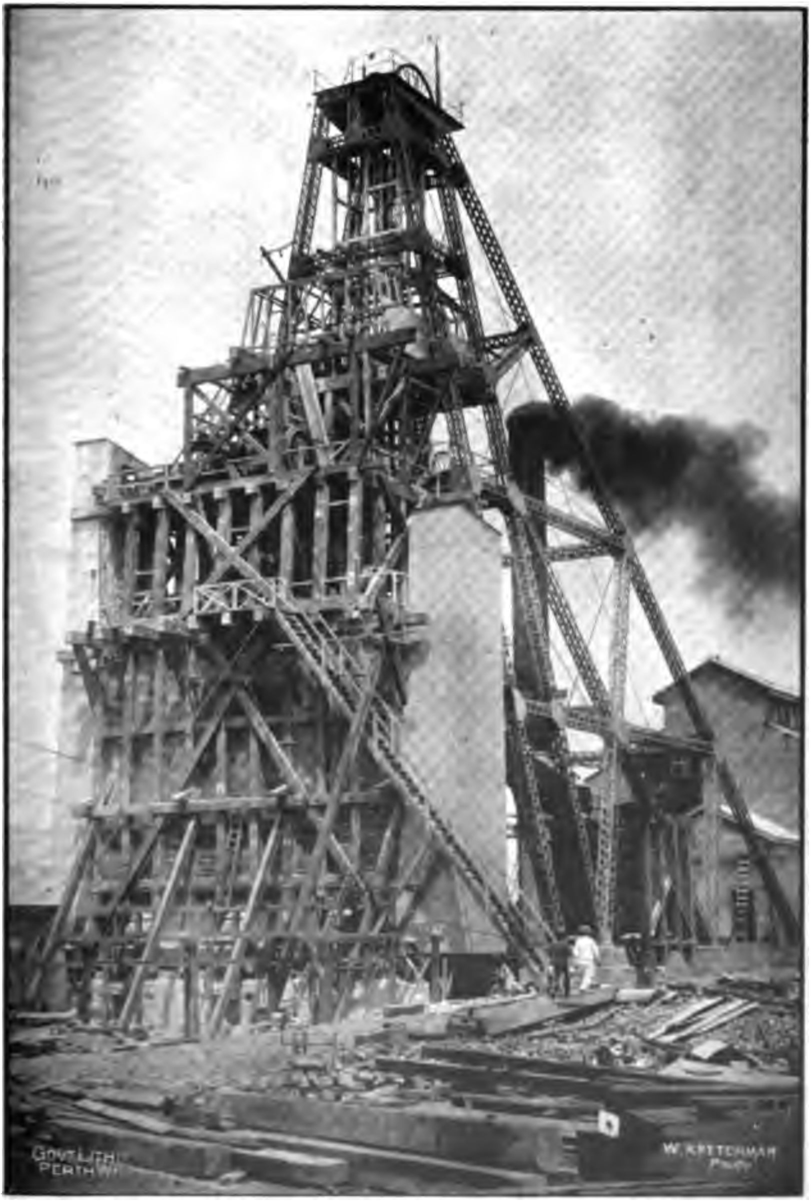
The original or surface patch of enrichment upon which this mine was started proved to be of very limited extent, its outcrop being 250 feet in length, whilst it only extended for a depth of 200 feet upon the lode plane, gradually diminishing in length to about 100 feet at the bottom.

The values in the ore channel were highest near the junction with the spur reef, from which point they gradually decreased downwards, but fortunately the latest reports convey the welcome information that they have very greatly improved at the bottom level.

In no mine up to the present time has a zone of enrichment been known to carry its values to an indefinite depth, but they usually occur in a more or less lenticular form one below the other, therefore when we consider the fact that payable ore in this mine has been proved to extend for a length of 1,500 feet in one continuous shoot a fluctuation in value was certain to occur.

The laws which govern this zonal enrichment have not as yet been discovered, but local enrichment can in most instances be accounted for. In the case of this mine its enrichment is evidently due to its position with regard to the contact of two formations, but he question as to whether another zone of increased values will be

PHOTO. 3.



Day Dawn Shaft.

met with below the one already worked, and being worked, cannot be answered owing to our limited knowledge.

It may be mentioned here that the character and occurrence of ore bodies in crystalline rock have not been so fully studied as those in the metamorphic and sedimentary series, owing to their much rarer occurrence, but in this case the improved values at the bottom level appear to indicate the occurrence of a second zone of enrichment.

Shafts.—This mine was originally developed from what is known as Armstrong's shaft, which is a vertical three compartment shaft measuring 10 feet by 4 feet inside the timber and 675 feet in depth. It passed through the lode between the Nos. 4 and 5 levels, but upon reaching the No. 8 level a crosscut had to be driven a distance of 200 feet to the reef, therefore a second main shaft called the Day Dawn shaft, measuring 15 feet by 5 feet inside the timbers was sunk further to the dip to a vertical depth of 1,250 feet, or between the Nos. 11 and 12 levels, at which point it cut the lode.

From this point the shaft was carried down upon the incline at first in the lode, but as this assumed a steeper dip below the No. 12 level a uniform grade was continued, and in consequence a crosscut had to be driven for a distance of 25 feet to connect with the lode at No. 13 level which is at a vertical depth of 1,500 feet.

In the vertical portion this shaft contains four compartments, two being skip roads for rapid haulage of the ore, and these two are continued upon the underlay, one cage or travelling way, which terminates at the bottom of the vertical section so far as the cage is concerned but continues as a ladder and a pipe way to the bottom level, whilst the fourth compartment, which is used for lowering pipes, timber, etc., terminates at the bottom of the vertical section.

All shaft sinking upon this mine is carried out by contract. The Day Dawn shaft, which is 17 feet by 7 feet 6 inches in the clear, cost £9 10s. per foot, the Company finding power, machines, timber, haulage and tool sharpening, the contractor only supplying labour and explosives. (Photo. 3.)

Above this shaft 110 feet steel head gear has been erected, the haulage being done by a first motion winding engine by Douglas and Grant, 22-inch cylinders by 36-inch stroke and 6-feet drums, whilst at the Armstrong's shaft there are a pair of direct motion engines by Martin, of Gawler, 13-inch cylinders by 24-inch stroke and 4½ feet drums. There are also three geared winches driven by air underground.

Driving and Crosscutting.—The lode is worked by a series of levels connected with the shaft by crosscuts, those above the No. 9 average rather under 100 feet apart, whilst those below average 200 feet. The dimensions of the drives are 8 feet by 8 feet, and exploratory crosscuts 7 feet by 5 feet, but the main levels upon the lode vary with the width of the ore body and the crosscuts connecting the shafts with levels are never under 8 feet by 8 feet.

As in the case of shaft sinking, this work is carried out by contract at the rate of £3 per foot by contract and under the same conditions, viz., the contractor only finds labour and explosives.

The ore body is exploited in depth by winzes, which are sunk from the lowest level in the mine, these being eventually connected with the shaft at their bottoms by the next level.

Two methods of timbering levels in the ore channel and opening stopes have been adopted in this mine, the first of which was employed in the upper portions of the mine when the ore was of high grade, therefore it did not pay to leave any of the stone behind; this was to secure the levels by the means of stulls and lagging (see Photo. 4) packed with refuse from the stopes, which latter were carried up from the back of the level, the ore being delivered into the trucks by shoots from the passes, the spaces between the latter being filled with refuse and later on with tailings.

In the lower levels where the ore is not of such high grade the ground is secured by cap pieces supported by two or more legs according to the width of the lode (Photo 5) whilst a portion of the vein is left intact immediately above the level. The stopes are opened from a series of passes which are carried up for a short distance through the solid ore above the level, they are then opened out in a fan-like shape until the wings join those from the next ones, thus forming wedge-shaped divisions with the points upwards, which guide the descending broken ore from the stopes above into the passes and shoots (Figure 1.)

The stopes are then carried up and the broken ore drawn from shoots as required, and as the stopes are usually allowed to remain nearly full during the process of breaking down men are in little danger of falls as they can stand whilst at work upon the broken ore ; it also has the advantage of economy since no timber is required and no handling to the passes.

All development in this mine is done with rock drills of the air valve type, mostly 2¾-inch to 3½-inch cylinders, but there are also some one-man drills of the same type, 2-inch to 2½-inch cylinders, there being a total of 32 machines employed upon this work.

The stopes are filled as far as practicable with rock from exploitation and development work, also with the refuse from the stopes themselves whilst the balance is made up of sands.

The ore is discharged from the shoots into trucks in the level and wheeled to the shaft where it is tipped into the ore bins after passing through coarse timber screens upon which pieces too large to pass are broken, whilst from these bins which are below the level the ore is drawn off into the skips and hauled to the surface.

The item of timber is a very large one on account of the great distance from which it has to be obtained, the average cost for the last six months amounting to £333 15s. 8d. per month.

Water Supply.—The water level in this mine is said to be 150 feet, but no reliable information is available as to at what level the

Fig. 1.

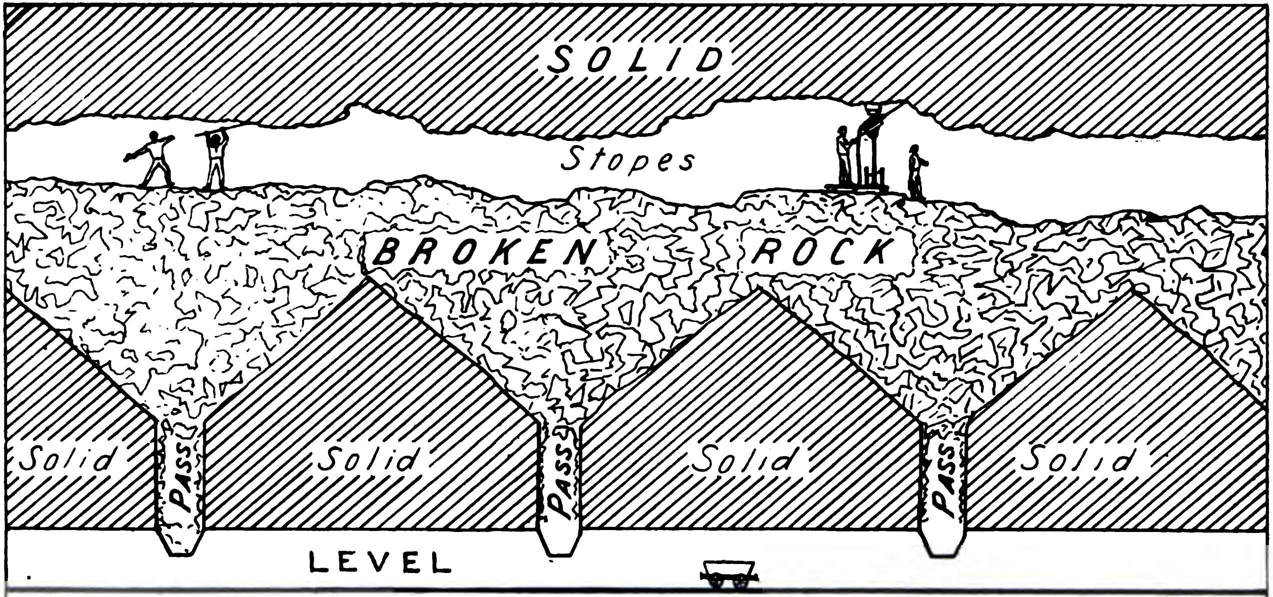


DIAGRAM
TO ILLUSTRATE SYSTEM OF OPENING STOPES

C.B. Kidson del

ground water stood before pumping was started, but it would probably be much closer to the surface. Below the water level is a zone of from 150 to 200 feet of saturation beneath which the country rock is completely dry, all the water encountered being due to seapage from the upper levels.

The water, which is highly mineralised and salt, amounting to 30,000 gallons per diem, is drained to the Armstrong shaft, from which it is raised to the surface by a 9-inch Cornish lift, whilst the seapage from the lower workings is raised to it by air pumps.

The *ventilation* is for the most part produced by natural circulation, but in dead ends, rises, etc., it is augmented by compressed air.

The *illumination* of the mine is afforded by electric lights on the plats and at the ore bins; elsewhere kerosene and candles are employed.

As 70,000 gallons of salt water are consumed daily upon these works and as the mine only yields 30,000 gallons or less than one-half, this has to be made up from various neighbouring shafts, but fortunately for this company, the East Fingall encountered a very considerable supply in sinking, which being allowed to run to waste on the Great Fingall leases is impounded.

About two-thirds of the fresh water supply for boiler purposes, etc., is obtained from three shafts upon the company's leases and the balance from the Cue and Day Dawn Water Supply. It will be seen that this item must also be a heavy one since it entails considerable pumping from different points outside the unwatering of the workings.

Surface.—Upon the surface a very complete up-to-date plant including extensive workshops in which even large castings can be turned out, thus effecting a very considerable saving both in expense and loss of time, the only fault that can be found with it from an economic point of view is want of concentration owing to the fact that as originally planned it was not proposed to work upon so extensive a scale.

The ore is delivered from skips into grizzleys, from these into rock breakers and so into ore bins upon the head gear, from which it is conveyed by aerial tramway to the 60-head mill and by belt to the 40-head when after passing over the tables the sulphides are withdrawn and roasted, whilst the sands and slimes are separated and directly cyanided, the slimes being run into settling reserves and the sands delivered by belt carriers to a dump which, being over 100 feet in height, forms a conspicuous landmark (Photos. 6 and 7).

Fuel.—This as well as the timber is a very serious item upon this mine, owing to the fact that the local supply in this district within a considerable radius has long since been cut out, and in consequence firewood costs 17s. 6d. per ton delivered at the boilers, whilst coal, which has to be used on account of the limited supply of the former, costs 19s. per ton at Geraldton, which is raised to

38s. 6d. by the addition of freight and handling. Of these upon th average 1,030 tons of coal and 1,374 tons of firewood are used pe month; therefore should the coal seams which are being prospecte at the Greenough crossing upon the railway line between Geraldto and Day Dawn turn out well, it will represent not only a nice littl contract for the coal company, but will mean a reduction of at leas 5s. per ton upon the fuel value, estimating it at two-thirds that o Newcastle coal.

Freight.—During the past six years this has amounted to th very considerable sum of £83,469; this will seem almost incredib to many persons, therefore a table has been attached showing th rates upon the main items.

Statement of Railway Freights on Main Lines.

Item	Station Received from	Rate per ton	Remarks.
Coal	Geraldton	18/2	Including Wharfa 1/4 ton.
Bar Iron and Steel	Fremantle	60/1	
General Hardware	do	130/4	Bolts, Nails, etc.
Coke	do	45/2	
Candles	do	171/3	
Firewood	Allens	4/9	
Do	Nallan	1/5	
Do	Yowergabbi	5/1	
Do	Moyagee	1/9	
Round Timber	Carnamah	24/1	
Zinc Shavings	Fremantle	130/4	
Pig Iron	do	13/1	
Lime	9-mile Siding near Geraldton	17/7	
Cyanide	Geraldton	74/–	
Cement	Fremantle	45/2	
Jarrah	Cardiff, Collie	37/10	
Charcoal	Chidlow's Well	45/–	
Split Slabs	Parkerville	31/6	
Oregon	Fremantle	90/3	
Karri	do	32/–	
Gum Logs	Mullewa	15/9	
Quicksilver	Fremantle	211/11	
Wire Screening	do	171/3	
Machinery	do	90/2	5 ton lots.
Rails	do	45/1	
Pipes and Fittings	do	130/3	
Rock Drill Spares	Kalgoorlie	245/10	
Do	Fremantle	171/–	
Fodder	Geraldton	25/9	
Oils	Fremantle	130/2	4 ton lots.

Costs.—When everything is taken into consideration it seem wonderful at what a low cost this mine is worked, which accordin to the annual report for 1906 of Messrs. Bewick, Moreing, and Co.

PHOTO. 4.

the general managers, amounted to 19/11.02 per ton, equal to .23 ounces of fine gold or about 4.7 dwts.

Table showing the yield of the Great Fingall Reef.

Year.	Name and Number of Lease.	Ore crushed.	Gold therefrom.	Rate per ton.
Prior to—		Tons.	Ozs.	Ozs.
1897	Day Dawn G.M.L., 1D ..	23,744.00	12,243.03	.51
1897	Do.	2,338.00	1,671.35	.71
1898	Do.	3,696.00	3,128.73	.84
1899	Great Fingall No. 1 ..	330.00	2,832.12	8.58
1900	Do.	4,447.00	6,824.07	1.30
1901	Do.	39,984.00	53,595.66	1.34
1902	Do.	75,939.00	95,392.68	1.25
1903	Do.	98,200.00	129,278.22	1.31
1904	Do.	141,973.00	156,712.90	1.10
1905	Do.	181,534.00	159,774.97	.91
1906	Do.	222,892.00	121,163.20	.54
	Total	**795,077.00**	**742,616.93**	**.93**

Table showing the yield of the Day Dawn North Reef.

Year.	Name and Number of Lease.	Ore crushed.	Gold therefrom.	Rate per ton.
Prior to—		Tons.	Ozs.	Ozs.
1897	Day Dawn No. 1 North, G.M.L., 2D	..	..	..
1897	Do.	..	..	..
1898	Do.	1,018.00	629.59	.61
	Total	**1,018.00**	**629.59**	**.61**

The Great Fingall North G.M.L. 189D.—To the northward of the Great Fingall mine and in the northern block belonging to that company the reef splits, the main portion being deflected sharply to the north-eastward, then assuming a northerly course in which direction it presents a bold outcrop of bluish quartz, extending for a distance of 15 chains. The western branch, which would appear at the surface to follow the main line of fissure in a northerly direction, can only be traced at the surface for a distance of 10 chains.

A considerable amount of work has been done upon this north end of the reef, which was originally known as the Union Jack, but it would appear that the stone was of little value since no returns appear in the official statistics.

The Great Fingall Associated G.M.L. 194D.—About half a mile north of the Great Fingall is the Great Fingall Associated Mine, it was originally known as the Cooya up till 1897, when it was abandoned to be taken up again in 1901, and held for one year under the name of the Fingall, after which it was taken up by the present company.

There are two lines of reef upon G.M.L. 194D, which it is claimed are the northern extension of the Great Fingall lodes, but although undoubtedly upon the same belt of country, it would need a great stretch of imagination to say that this was a fact.

The main reef upon which the greater quantity of work has been done lies upon the western side of the property, having a nearly north and south course for a distance of seven chains, when it takes a more easterly course for three more chains, after which it is lost, the general direction of its dip being 55 degrees west. A main vertical shaft has been sunk to a depth of 205 feet, from which at a depth of 125 feet the reef was crosscut at a distance of 40 feet, and passed through at a depth of 165 feet, the water level being 78 feet.

A considerable amount of work has been done from an old underlay shaft upon the reef, which workings are now connected with the main shaft by the crosscut at the 125-feet level.

The country is hard amphibolite, except in the immediate proximity of the lode when it becomes more schistose.

Table showing the yield of the Great Fingall Associated Reef.

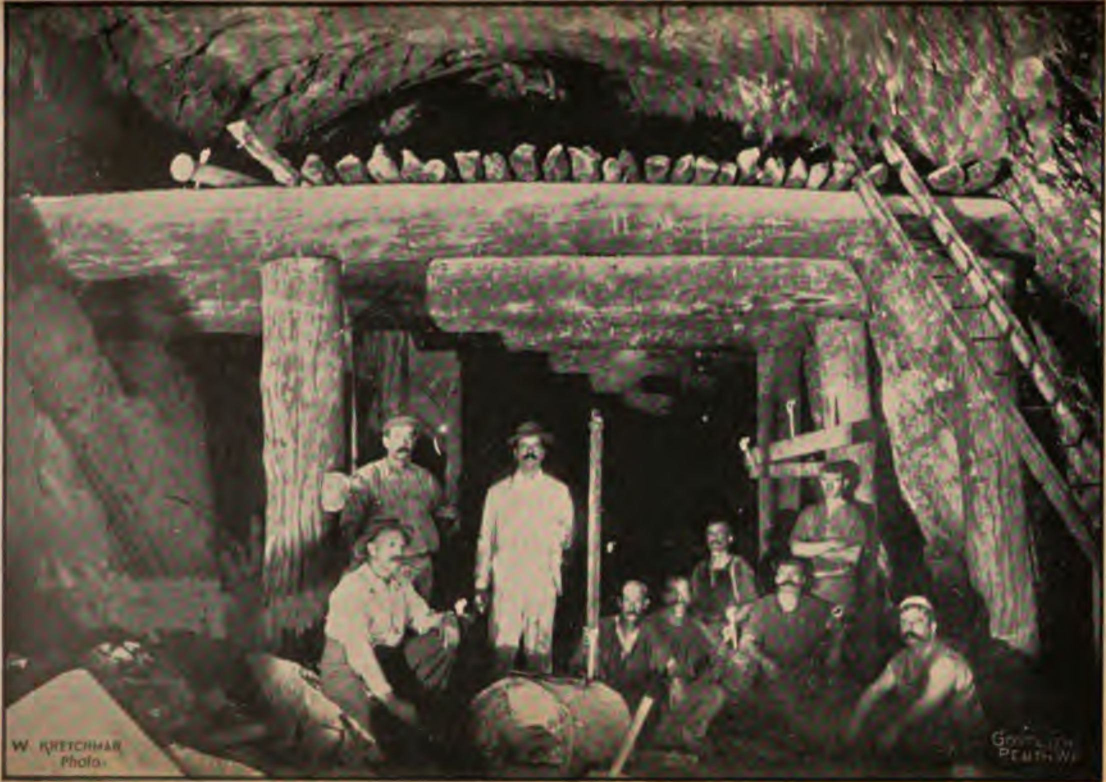
Year.	Name and Number of Lease.	Ore crushed.	Gold therefrom.	Rate per ton.
Prior to—		Tons.	Ozs.	Ozs.
1897	Cooya G.M.L., 28D ..	50.00	36.67	.73
1897	Do.	35.00	14.74	.42
1901	Fingall G.M.L., 239D ..	50.00	22.17	.44
1906	Great Fingall Associated No. 2 G.M.L., 332D	30.00	4.00	.13
	Total	**165.00**	**77.58**	**.47**

Sterns G.M.L. 237D (abandoned).—To the northward of the last-mentioned are a number of leases, which were originally known as Sterns No. 1, 2, 3, etc., but which in 1903 became the property of the Cue Mining and Exploration Company, Ltd., when they were worked in conjunction with a large number of other leases, and as a consequence no particulars are available as to the production from any individual lease.

The reefs on these leases are also supposed to be the northern extension of the Great Fingal lode, they have a north and south course and dip to the west.

A considerable amount of shallow work has been done upon these, but they are apparently of little value, otherwise they would not be idle as they are at present.

A diamond drill bore was put down by Capt. W. Hoskins to a depth of 550 feet, which passed through greenstone for its entire depth, sometimes intersected by small veins of quartz and calcite with pyrites, whilst below a depth of 529 feet the country became more schistose with numerous stringers of quartz and pyrites, but no values were cut.



Timbering with Legs and Caps.

Royal Charter G.M.L. 181D.—A little to the eastward of the last is the old mine, which was formerly known as the Groper, and later on as the Royal Charter. The reef here has a more or less north and south course with a dip to the west, but the southern end sweeps away round more to the south-east.

There are two shafts upon this reef which have been sunk to a depth of 60 and 70 feet respectively, they were also connected by a drive about 90 feet in length.

The shoot of gold was worked from an open cut a little to the northward of the north shaft, from which some very rich stone is said to have been taken. This shoot apparently dipped south since it was cut in the north shaft and later on in the level between which and the surface it has now been entirely stoped out.

Table showing the yield of the Royal Charter Reef.

Year.	Name and Number of Lease.	Ore crushed.	Gold therefrom.	Rate per ton.
		Tons.	Ozs.	Ozs.
1898	Groper G.M.L., 156D ..	172.00	158.70	.92
1900	Royal Charter G.M.L. 181D	85.00	212.36	2.48
1901	Do.	30.00	9.76	.32
1903	Do.	32.00	20.19	.63
1904	Do.	29.00	14.83	.51
1905	Do.	72.00	49.50	.69
1906	Do.	69.00	15.04	.22
	Total	**489.00**	**480.74**	**·98**

The Rubicon G.M.L. 138D, *etc.*—A little to the northward of the Groper is the Rubicon mine, which became the property of the Murchison Associated Gold Mines, Ltd., in 1901, before which time it was privately owned.

The reef has a general strike of north and south with a dip that varies from 52 to 75 degrees to the west, it occurs in the main upper workings as two parallel bodies from 15 to 20 feet apart, which junction about 50 feet south of the main underlay shaft.

Of these the eastern is called the No. 1 lode, and the western the No. 2, but it is upon the former that by far the most work has been done.

The mine was originally worked from an underlay shaft, which was sunk from the surface to a vertical depth of 500 feet upon the footwall side of the No. 1 lode. From this shaft levels were driven first the No. 1 at a vertical depth of 90 feet for a distance north of 180 feet, and south 100 feet upon the No. 1 lode, and 25 feet north and 50 feet south upon the No. 2 lode.

The No. 2 level, which is at a vertical depth of 144 feet, was driven for a distance of 145 feet north and 30 feet south upon the No. 1 lode, and 130 feet north and 125 feet south upon the No. 2 lode.

The No. 3 level at a depth of 248 feet was driven 120 feet north and 110 feet south upon the No. 1 lode, whilst from the south end a crosscut was driven 15 feet west to the No. 2 lode, which was followed for a distance of 135 feet south.

The No. 4 level is at a vertical depth of 310 feet, and has been driven 245 feet north and 220 feet south on the No. 1 lode, whilst the No. 2 lode has only been touched by a crosscut.

In these upper workings, the No. 1 lode varied from 5 to 6 feet in thickness, and the No. 2 from 5 to 12 feet, the stone being of a bluish tint. No driving was done from the No. 5 plat, but at the No. 6, which is the bottom of the underlay shaft, it is connected with the main vertical shaft at a depth of 500 feet by a crosscut 200 feet in length, whilst the level upon the lode has been driven for a distance of 110 feet north in a solid body of quartz for a short distance, the remainder being broken quartz and formation to the face. To the south it has been extended for a distance of 224 feet in a solid quartz reef which varies from 12 to 14 feet in thickness having a good hanging wall to within a short distance of the face where it gives place to formation.

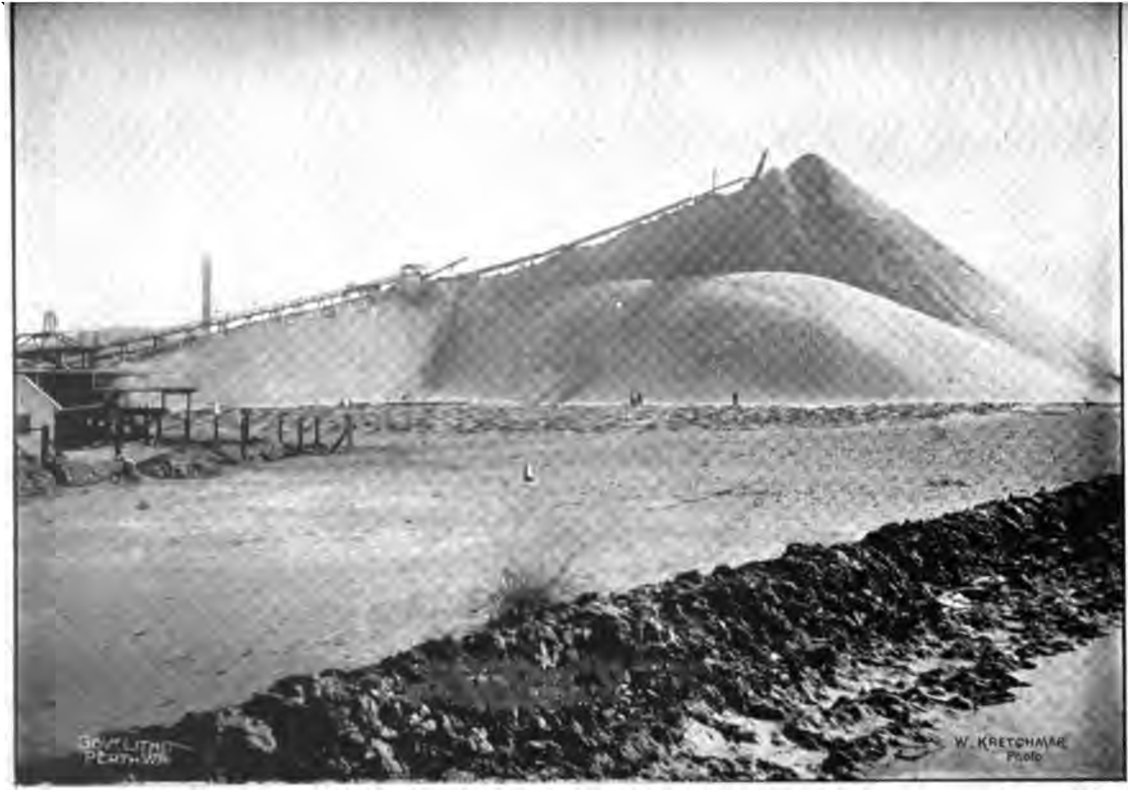
The No. 7 level is connected with the main vertical shaft at a depth of 800 feet by a crosscut 40 feet in length and the lode driven on 504 feet north in a formation 13 feet in thickness, which occasionally makes into a solid quartz body for a short distance and at one point 300 feet from the crosscut a bunch of copper pyrites was cut. The south level was driven for a distance of 427 feet and in it very little quartz was met with the lode consisting for the most part of formation 15 feet in thickness.

The country in which the lode is contained in the lower workings is a solid blockey greenstone generally without good walls. The lode in these lower workings is as a rule of low grade but of great size, including the formation which is of a schistose nature whilst the walls do not as a rule with the exception of the No. 6 south level present polished or striated surfaces.

The water level in the mine is 100 feet below the surface but in sinking the main shaft little water was encountered until the old workings were cut, whilst below the 300 feet level upon the lode the country was found to be solid and quite dry.

From this mine the official records show that 3,500 tons of stone have been crushed, which yielded on the average a little over half-an-ounce per ton of fine gold, inclusive of the sands treatment, whilst to judge from the plan the greater proportion of this came from above the No. 2 or 144 feet level, below which very little stoping has been done.

The plant upon the property consists of a 10-head battery, cyanide vats, with winding engines at both shafts, boilers, pump



Tailings Dump.

Table showing the yield of the Rubicon Reef.

Year.	Name and Number of Lease.	Ore crushed.	Gold therefrom.	Rate per ton.
Prior to—		Tons.	Ozs.	Ozs.
1897	Rubicon G.M.L., 138D ..	396.00	208.66	.52
1897	Do.	405.00	300.26	.74
1898	Do.	204.50	136.18	.66
1899	Rubicon Leases 138D, 166D, 167D	485.00	313.53	.64
1901	Murchison Associated G.M. Ltd., 138D, 166–7D	52.00	11.39	.22
1902	Do.	360.00	163.64	.45
1903	Do.	227.00	123.78	.54
1904	Do.	1,091.00	807.97	.74
1906	Do.	283.00	151.20	.55
	Total	**3,503.50**	**2,216.61**	**.63**

The San Diego, M.L. ID, *now P.A.* 65D.—Upon a rough ridge to the eastward are some prospecting areas which are at present being worked for copper, upon which was originally the old Nimrod or San Diego.

The lode, which is a quartz body containing small bunches of strings of green and blue carbonate of copper, strikes in a north-west direction and dips to the south-west.

A considerable amount of work was done in the early days, but only 15.65 tons of ore were shipped, which realised £167; later on some 30 tons of stone were crushed, which yielded gold at the rate of 1½ ounces per ton.

These old workings have been reopened during the last year as P.A. 65D, and 25.21 tons of copper ore obtained from the old workings and redressing spoil heaps, which contained 10 per cent. of copper, valued at £190.

The Croesus, G.M.L. 182D.—To the northward of the Rubicon is the old Crœsus mine, which has been worked to the 100 feet level by a series of underlay shafts upon a lode which outcrops for a distance of 15 chains striking a little to the eastward of north and dipping to the westward.

This mine has not been worked since it was acquired by the Murchison Associated Company in 1899, but prior to that date over 1,000 tons of stone had been crushed, which yielded gold at the rate of nearly 1½ ounces to the ton over the tables, no returns being given of the value of the sands; it seems strange that this company has devoted all its capital upon a property in which the stone was not of half the value.

Besides the auriferous reef there is a copper lode upon this property, which crosses the south-west corner of the lease upon a course a little west of north and dips to the westward.

The vein was apparently small in size consisting mostly of quartz with a little blue and green carbonate of copper in strings, the ore needing a considerable amount of dressing.

So far as can be ascertained, only five tons of ore have been shipped, but no record is obtainable of its value, although despatched to Wallaroo in 1906.

Table showing the yield of the Crœsus Reef.

Year.	Name and Number of Lease.	Ore crushed.	Gold therefrom.	Rate per ton.
Prior to--		Tons.	Ozs.	Ozs.
1897	Croesus G.M.L., 14D ..	762.00	1,309.15	1.85
1898	Do.	319.00	295.80	.92
1899	Do.	57.00	35.46	.62
	Total	**1,138.00**	**1,640.41**	**1·44**

The Day Dawn West G.M.L. 211D.—To the south-westward of the Great Fingall mine is a reef which first runs in a south-westerly direction for a distance of 8 chains, from which point it makes a turn to the westward for a length of about 3 chains, the dip in the first section being 56 degrees to the south-east and the second 30 degrees to the south.

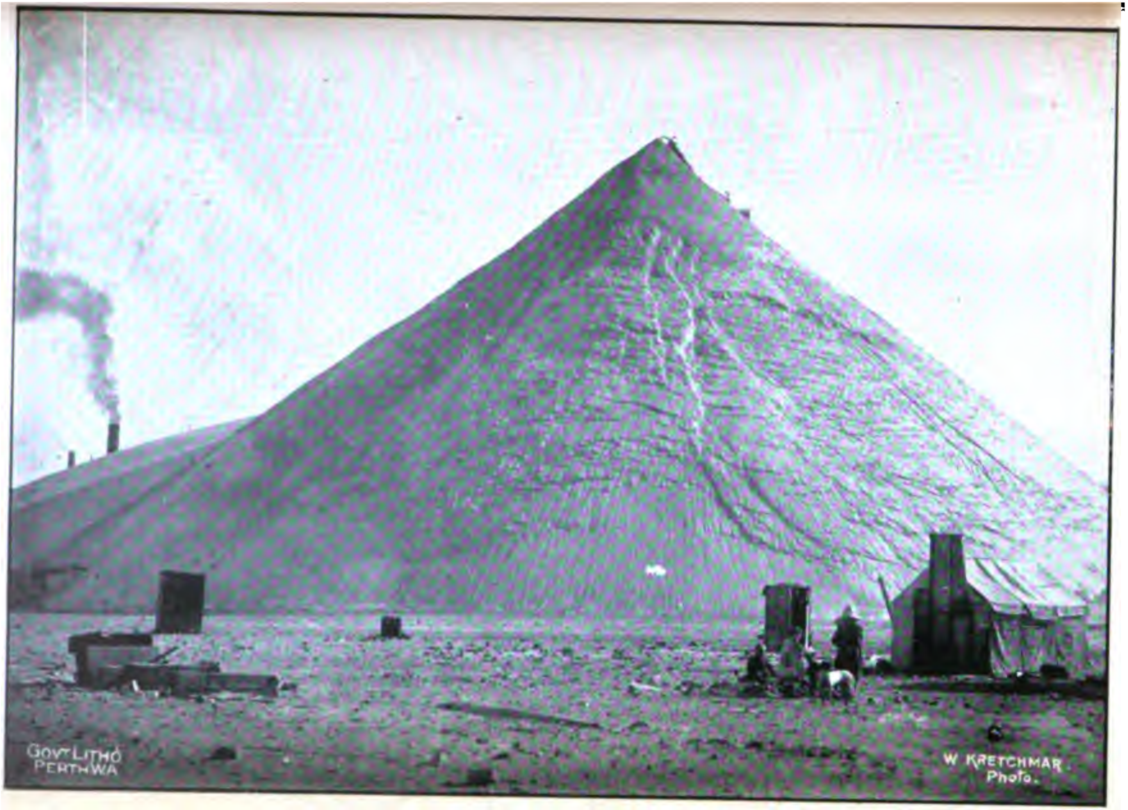
This mine was first known as the Day Dawn West, whilst later it was owned and worked by the Consolidated Murchison G.M. Ltd., until the year 1899, when it became the property of the West Fingall, Ltd., in conjunction with a number of adjoining leases, which now have all passed into the hands of the Great Fingall Consolidated. It has not been worked since the year 1898, but prior to that date considerable developments took place, these consisted first of a number of underlay and vertical shafts from the surface to the 50-feet level, which is 700 feet in length. The shoot of ore in this level has been worked for a length of 300 feet and stoped to the surface, where, however, it diminished to 150 feet in length.

The No. 2 level is connected with the bottom of Wallace's shaft, which is 85 feet in depth by a crosscut 100 feet in length, the reef being driven in for a length of 800 feet, whilst the shoot stoped between this and the No. 1 level is 300 feet in length.

Below this level this mine was worked by a main underlay shaft, which was sunk to a vertical depth of 160 feet, the No. 3 level being at 127 feet and driven for a length of 300 feet, whilst stopes of 200 feet in length were carried up to the No. 2 level, whilst a little underhand stoping was done below this level.

The No. 4 level at 155 feet from the surface was driven for a length of 250 feet, but since no stoping was done the reef apparently carried no values. Later on a crosscut was driven by the West Fingall Company, which cut this reef at the 215 feet level which was carried a length of 250 feet in apparently valueless stone.

This reef is a cross fissure running at right angles to the strike followed by the Great Fingall and the Golden Crown lines between which it lies, the values in it occurring only upon the curve at the



GOVT LITHO
PERTH WA

W KRETCHMAR.
Photo.

Tailings Dump.

LIBRARY
OF THE
UNIVERSITY
OF
CALIFORNIA

south end, at which point the reef dips, flattens, and turns to follow more of a normal course.

Table showing the yield of the Day Dawn West Reef.

Year.	Name and Number of Lease.	Ore crushed.	Gold therefrom.	Rate per ton.
Prior to—		Tons.	Ozs.	Ozs.
1897	Day Dawn West G.M.L. 7D	2,922.00	1,996.25	.68
1897	Do.	3,548.00	2,863.48	.80
1898	Do.	2,286.00	1,350.25	.59
	Total	**8,756.00**	**6,209.98**	**.71**

The Queen's Birthday G.M.L. 66D.—A short distance to the westward of the last mentioned is a main fissure line which can be traced upon a course a little west of north for a distance of over a mile, the quartz bodies in which dip to the westward and are almost continuous at the surface.

At the northern end of this line are some old workings known as the Queen's Birthday, from which 33 tons of stone were crushed yielding gold at the rate of .22 ounces per ton.

The Pelican G.M.L. 101D.—A little farther south are the old workings which were known in the early days of this field as the Pelican, from which 25 tons were raised which yielded 26.59 ounces of fine gold.

The Golden Crown G.M.L. 78D.—Farther south still is the old Golden Crown lease, which afterwards became the Fingall Deeps of the West Fingall, Ltd., and is now owned by the Great Fingall Consolidated.

The individual quartz body worked upon this lease can be traced for a length of 15 chains at the surface upon a north-west course with a dip of from 52 to 67 degrees and an average size of 2 feet.

The old workings consist of a number of underlay shafts down to the 50-feet level, which has been driven upon the lode for a length of 430 feet, and it is from here that all the stone crushed was raised.

A main vertical shaft was sunk by the West Fingall Co. to a depth of 255 feet, but since this was put down upon the outcrop of this reef it was necessary to crosscut a distance of 80 feet at the 155 feet level where the reef has been driven upon 190 feet and 110 feet at the 215 feet level, which latter is 500 feet in length.

From this level a crosscut has been driven in a north-easterly direction for a distance of 440 feet to the Day Dawn West reef, which was then followed for a length of 250 feet, but no stoping was done.

Five diamond drill bore holes were put down in hard massive amphibolite, which near the surface is schistose with green bands of epidote.

The official records show that only 110 tons of stone were crushed from this mine, which yielded 130.58 ounces of fine gold.

The Perseverance G.M.L. 174D (abandoned).—Rather over half-a-mile to the southward is what was known first as the Perseverance and later on as the Try Again, the reef in which outcrops for a length of 18 chains upon a north and south course with a dip of 80 degrees to the westward, and is in all probability the southern continuation of the Golden Crown fissure; whilst the second reef which was worked at the south-west corner of this lease is most probably the continuation of the Smith's United fissure to be next described.

The work upon this reef is all of a shallow character, but the stone raised appears to have been of good value.

Table showing the yield of the Perseverance Reef.

Year.	Name and Number of Lease.	Ore crushed.	Gold therefrom.	Rate per ton.
		Tons.	Ozs.	Ozs.
1897	Perseverance G.M. L., 46D	37.00	22.31	.60
1899	Do.	11.50	12.73	1.10
1899	Try Again G.M.L. 174D ..	15.25	58.39	3.82
1900	Do.	28.00	15.17	.54
1901	Try Again, G.M.L. 267D ..	6.00	6.05	1.01
	Total	**97·75**	**114·65**	**1·17**

The St. Albans G.M.L. 119D.—Parallel to the last mentioned line is another fissure the quartz bodies in which are not nearly so continuous, some 20 chains of a break occurring between the northern outcrop and the southern.

At the north of this line is the old St. Albans mine, upon which the reef outcrops for a length of 10 chains, having a north-westerly course with a dip of 53 degrees to the south-west.

It was worked by two underlay shafts, sunk to a depth of 80 and 96 feet respectively, and a main vertical shaft to 125 feet, from which a crosscut has been driven at a depth of 90 feet to the lode, which was followed for a length of 320 feet.

Recent sampling by the Great Fingall Co., to whom it now belongs, proved that the reef at the 90 feet level was too poor to pay working expenses.

From this mine 43 tons of stone were crushed, which yielded 15.33 ounces of fine gold.

The main shaft is now used as a fresh water supply.

The Smith's United G.M.L. 212D.—Twenty chains to the sou ward upon the same line are the old workings that were known Smith's United, the reef here still has the north-westerly strike a outcrops for a length of 18 chains dipping at an angle of 65 degr to the westward.

The ore raised from this mine came from an opencut mai but nothing from below the 50-feet level, which is 70 feet in len and is connected with the main vertical shaft by a 70-feet crosse

The 150-feet level, which is 150 feet in length, is connected with the main shaft, which is 180 feet in depth by a 30-feet crosscut. Recent sampling of the bottom level in this mine proves that the good values met with near the surface do not continue below.

Table showing the yield of the Smith's United Reef.

Year.	Name and Number of Lease.	Ore crushed.	Gold therefrom.	Rate per ton.
Prior to—		Tons.	Ozs.	Ozs
1897	Smith's United, G.M L. 146	44.00	39.62	.90
1897	Do.	73.50	212.76	2.89
1898	Do.	40.00	106.98	2.67
1899	Do.	5.00	1.88	.37
	Total	**162.50**	**361.24**	**2.22**

The Golden Ridge G.M.L. 667D.—Upon a low ridge about 1¼ miles to the westward of Day Dawn are some old workings upon short reefs striking north and south with a westerly dip, known as the Great Western and Aurifer, the latter being later on called the Golden Ridge, from which 54 tons of stone were crushed yielding 28.73 ounces of fine gold.

About half-a-mile farther south upon the western side of the Rifle Range there are some more old shafts but no quartz outcrop, from which 50½ tons of stone were crushed for 28.43 ounces of fine gold. Upon the western side of the Trenton Hill are some more old workings, which include the Ada Mary or Ivy Mary, the Klondyke and the Southdown; from the former of these 89 tons of stone yielded 35.43 ounces of fine gold, and from the second 191½ tons of stone gave 73.83 ounces of fine gold, the latter upon which considerably more work was done is shown in the following table :—

Table showing the yield of the Southdown Ree.

Year.	Name and Number of Lease.	Ore crushed.	Gold therefrom.	Rate per ton.
Prior to—		Tons.	Ozs.	Ozs.
1897	Southdown, G.M.L. 115 ..	267.00	412.36	1.54
1897	Do.	54.00	81.78	1.51
1898	Do.	12.00	11.45	.95
1899	Southdown, G.M.L. 162 ..	96.00	131.15	1.36
	Total	**429.00**	**636.74**	**1.48**

The Mount Fingall G.M.L. 320D.—Upon a steep island-like hi , surrounded by a large alluvial flat about 1½ miles south of th Trenton Hill, is a mine which was originally known as the St thmore, but now is the Mount Fingall.

The reef which crosses a saddle in the ridge strikes a little west of north and dips to the westward at an angle of from 45 to 50 de ees, the quartz varies from 2 to 7 feet in width, averaging about 4 t, being contained in a large schistose formation which carries a little gold in places, the whole being enclosed in hard massive amphibolite.

This reef has been worked by a main underlay shaft sunk to a vertical depth of 276 feet, and a main vertical shaft 60 feet farther south to a depth of 200 feet.

The No. 1 level is at a vertical depth of 120 feet, and has been driven upon the reef for a length of 130 feet, this is the highest level that is at the present time accessible, as the upper workings have fallen in.

The No. 2 level is at a vertical depth of 200 feet, and has been driven north from the bottom of the vertical shaft for a distance of 100 feet, whilst the No. 3 level has been started from the underlay shaft at a vertical depth of 70 feet below the No. 2 level.

The water level in this mine is at 60 feet below the top of the hill, and yields 500 gallons per hour.

There is a small battery with a winding and pumping plant upon the mine.

Table showing the yield of the Mount Fingall Reef.

Year.	Name and Number of Lease.	Ore crushed.	Gold therefrom.	Rate per ton.
		Tons.	Ozs.	Ozs.
1898	Strathmore, G.M.L. 163D ..	47.00	26.73	.51
1902	Mount Fingall, G.M.L. 273D	74.00	33.22	.45
1903	Mount Fingall, G.M.L. 320D	14.00	8.57	.61
1904	Do.	485.00	258.07	.53
1905	Do.	936.00	514.46	.65
1906	Do.	300.00	228.39	.76
	Total	**1,856.00**	**1,069.44**	**57**

The Day Dawn G.M.L. 398D.—Upon a low hill to the westward of the racecourse is a reef that was discovered about two years ago called the Day Dawn, after the original mine of the district, which is now known as the Great Fingall.

The main reef has an east and west course for a length of four chains, and an underlay at a low angle to the northward, it has been followed down upon the underlay for a distance of 80 feet, and a vertical shaft has been sunk to a depth of 54 feet 6 inches, the water level being at 25 feet.

From the cap of this reef a flat spur or leg seems to dip to the south, giving it the appearance of a saddle formation, and it was from the apex of this that the richest stone was obtained.

A series of shafts sunk in the adjoining lease at the eastern end of the outcrop failed to cut this reef, whilst at the west end it is cut off by a reef having a north-west course, and a dip to the north-east.

The country as far as followed down is a soft schistose amphibolite, more or less weathered, and the water is quite fresh. From his lode up to the end of 1906 some 90 tons of stone had been crushed, which yielded 258.59 ounces of fine gold.

The Emperor G.M.L. 191D.—Upon the large alluvial flat which constitutes the main drainage channel between Day Dawn and Austin Lake, and about 1½ miles south-west of that town is a reef which outcrops for a length of 11 chains upon a north-westerly course with a dip of 62 degrees to the south-westward, this was from the early days of the field until last year known as the Emperor, but now is called the Fingall Extended.

The workings upon this lease consist of a number of underlay shafts to the 45 feet level, which in the year 1895 is reported to have been 70 feet in length; this, however, was extended afterwards, but has now fallen in.

A main vertical shaft has since been sunk to a depth of 200 feet, with a level 141 feet in length from its bottom; there is also a level at the 110 feet which has been driven upon the lode for a length of 264 feet, but no stoping has been done below this level and little only below the 45 feet, which was just above the original water level, this latter has now risen to within 20 feet of the surface.

The water is very salt, and is reported to have made in the year 1894 at the rate of 1,000 gallons per hour, but this has now considerably increased.

The surrounding rock is schistose amphibolite near the surface and along the lode fissure, but is very solid and blocking in the main shaft.

In the upper levels the reef was 2 feet 6 inches in thickness, but there is no information to hand as to its size in the lower workings, which are now flooded.

There was a five-head stamper battery, winding engine, pumps, etc., upon this mine, but these have now all been removed.

A diamond drill bore hole was put down to a depth of 510 feet upon this lease to test the lode at a depth, but in this no values were cut.

Table showing the yield of the Emperor Reef.

Year.	Name and Number of Lease.	Ore crushed.	Gold therefrom.	Rate per ton.
		Tons.	Ozs.	Ozs.
Prior to—1897	Emperor G.M.L. 15D ..	651.00	1,949.30	2.99
1897	Do.	952.45	748.41	.78
1898	Do.	25.00	24.75	.99
1899	Do.	110.25	93.36	.84
1901	Do.	28.00	12.36	.44
1903	Do.	72.00	23.08	.32
1905	Do.	11.00	23.50	2.13
	Total	**1,849.70**	**2,874.76**	**1.55**

The Trenton, G.M.L. 399D.—This property, which consists of G.M.Ls. 288D, 399D, and 400D, covers an area of 56 acres, and is situated half a mile east of the Trenton Hill sub-trig. station, and one and a half miles south-west of the Great Fingall Mine.

It was originally held by a company as G.M.L. 23D, who worked it until the year 1896, during which time 7,732 tons of stone were crushed which yielded 5,507.05 ozs. of fine gold; the sands were treated later on by the Murchison Consolidated but no record appears as to their value; they are said, however, to have gone 6dwts. per ton, which is quite possible.

The Company had a ten-head mill with pumping and winding plant.

In the year 1897 no returns appear but in 1898 the records show a return of 16 tons of stone crushed which yielded 15.55 ozs. of fine gold, the lease number appearing as 148D.

In 1899 it was voided for non-payment of rent, when the southern portion was taken up as Quartz Claims 31 and 32, and during the two succeeding years 189.10 tons of stone were crushed which yielded 171.22 ozs. of fine gold.

In 1902 no returns are given, but in 1903-4-5 this mine appears again as G.M.L. 227D, during which period 800 tons of stone were crushed which yielded 504.16 ozs. of fine gold (this includes 194 tons crushed by Mr. Thompson in 1905, which yielded 120 ozs. of gold of which no official record appears).

In 1905 it passed into the hands of the present Company, who have since devoted their entire energies to its development by sinking a main underlay shaft on the incline.

From the above it will be seen that a total of 8,746 tons of stone have been crushed from this mine which have yielded 6,198 ozs. of fine gold, which is at the rate of .71 ozs. per ton.

With the exception of the last 700 or 800 tons crushed, no record exists of the value of the sands; these are said, however, to have yielded gold at the rate of 6 dwts. to the ton when treated and this is quite possible since in the early days of this field crushing was done in a more or less crude manner.

Should this value be correct it will bring up the value of the stone crushed to close upon an ounce of gold to the ton.

The new main shaft, which is now down 408 feet, measures 12 feet by 4 feet 6 inches, its gradient for the first 300 feet being 54 degrees, but since the lode pitched below this it was altered to 64 degrees, but still remains in the hanging wall of the reef. With the exception of this, little development has been done upon this property since it was held by the old Company in the early days, most o he recent work being confined to the zone above the water level ch is 80 feet.

The old main shaft was vertical and sunk to a depth of 50 feet with crosscuts 90 feet in length to the No. 1 or 100 feet el, of 5 feet to the No. 2 or 190 feet level, and of 40 feet to the 3 or 235 feet level, the reef being passed through immediately w the No. 2 level.

The No. 1 level has been driven for a distance of 75 feet to the orth of the crosscut and 275 feet to the south, the No. 2 level 105 eet north and 90 feet south, whilst the No. 3 level has been driven 40 feet to the north, the new main shaft being broken into at 80 eet from the crosscut.

About 4 chains north of the main shaft is an old shaft which has been sunk to a vertical depth of 60 feet at the bottom of which a level was driven 20 feet north; as the reef however was much broken it was used as a water shaft on account of the water being of a better quality for boilers than that from the mine.

At 140 feet south of the main shaft is the No. 1 underlay shaft and at 60 feet farther south the No. 2; these are said to have been sunk to a depth of 80 feet, but they have now been filled up to the 0 feet intermediate level driven by the recent owners in order to work a southern shoot above the water. This level was connected with the No. 1 level by a winze but this is also filled in.

The lode strikes about 20 degrees west of north and outcrops for a distance of 10 chains, dipping at an angle of 55 degrees between the surface and the No. 1 level, at 45 degrees between the Nos. 1 and 2, and 40 degrees between Nos. 2 and 3, after which it appears to pitch since the main underlay shaft, which has been carried down at an angle of 64 degrees has not broken into it, although close upon the hanging wall at the No. 3 level.

The size of the reef varies considerably, starting small at the surface but increasing to 3 feet at the No. 1 level, 5 to 6 feet at the No. 2 level, and 8 to 12 feet at the No. 3, but at each level it either cuts out or pinches at the ends.

To judge from the plan of the workings (the southern being inaccessible) there are two shoots in this mine, the one worked by the original company has been worked out for a length of 170 feet at the surface and stoped for a length of 205 feet above the No. 1 level, and 140 feet below it above the No. 2 the stone has been stoped for a length of 175 feet, whilst below this level practically no stone appears to have been stoped.

The south shoot has been worked out for a length of 65 feet at the surface and 55 feet above the 60 feet level.

This last-mentioned shoot being situated upon abandoned Q.Cs. 31 and 32 is evidently responsible for the production of the 189 tons of stone crushed between 1899 and 1901, which yielded 171.22 ozs. of fine gold reported from these claims, it is also probable that the greater portion of the 615 tons crushed in 1903-4 which yielded 384 ozs. of fine gold also came from this portion of the mine, as the total of these two amounts practically represents the cubic contents of the stopes. The balance of 7,902 tons, which yielded 5,643 ozs. of fine gold, in all probability came from the north shoot, as nearly all of it was raised by the old company.

It will therefore be seen that the northern shoot, without the addition of the tailings, is of an equal grade to the southern, the returns from which include the cyanide extraction.

The country is extremely hard amphibolite, which necessitates the employment of rock drills ; this fact probably accounts for the original company crosscutting to the lode before reaching the 300 feet level.

There is no reliable information as to the actual value of the large body of stone met with at the No. 3 level, since with the exception of a small parcel of stone taken out by Mr. Thompson, the present company do not appear to have done any systematic sampling, but it seems strange that, unless the stone proved to be poor, the original company should have abandoned a mine, leaving a fine block of ground unstoped when all the dead work had been done and there was a battery on the ground.

It is quite possible however, that this large body of quartz, although considered to be of too low a grade to work in the early days, may pay well with the aid of modern appliances, and the point can be simply set at rest by sampling.

It will be noticed that the great increase in size of the stone occurs in that portion of the vein where the angle of dip is lowest, and probably poorest, therefore it is quite possible that richer stone but smaller in size may be met with below the bottom level where the reef pitches.

Table showing the yield of the Trenton Reef.

Year.	Name and Number of Lease.	Ore crushed.	Gold therefrom.	Rate per ton.
Prior to—		Tons.	Ozs.	Ozs.
1897	Trenton G.M.L. 23D ..	7,732.00	5,507.05	.71
1897	Do.	..	..	..
1898	Trenton G.M.L. 148D ..	16.00	15.55	.97
1899	Trenton Q.C. 31 and 32 ..	98.10	65.25	.66
1900	Do.	82.00	92.05	1.30
1901	Do.	9.00	13.92	1.55
1902	Do.	..	..	..
1903	Trenton G.M.L. 227D ..	460.00	181.34	.39
1904	Do.	155.00	202.66	1.76
1905	Do.	194.00	120.16	.62
	Total	**8,746.10**	**6,197.98**	**.71**

The Bonnie Scotland, G.M.L. 215D.—Close to the Cue road about half a mile north of Day Dawn, is an old shaft upon the alluvial flat which forms the main drainage channel of this belt of country. This shaft was sunk by a party who called this mine the Bonnie Scotland, but although the 6½ tons crushed from it yielded 13 ounces of fine gold, it is now used as a well and the surface as a market garden.

The White Horse, G.M.L. 331D.—A little south of the last-mentioned, just within the township area, is a large quartz blow which strikes from east to west and dips to the south; this was called first the White Horse and later on the New Fingall. Several shafts have been sunk upon it, but since the vein appears to flatten and cut out in depth and to be of low value, it has been abandoned. In all some 22 tons of stone were crushed, which yielded 14.60 ounces of fine gold.

East Fingall G.M., Ltd., G.M.L. 26D, *etc.*—Upon the other side of the railway line from the last mentioned in the Eureka No. 5, now the property of the East Fingall G.M., Ltd., who are at present engaged in testing the Eureka lode at a depth.

This reef has a course a little to the east of north and underlies to the west at an angle of 58 degrees from the first 100 feet and at 35 degrees at the bottom of the winze, it was worked by a main vertical shaft 100 feet in depth and two underlay shafts to the No. 1 or 60 feet level, which is 390 feet in length, above which the lode has been stoped to the surface for a length of 250 feet.

The No. 2 or 100 feet level was driven upon the lode for a length of 280 feet, of which 120 feet was good ore, and stoped up to the No. I level. The 120 feet or No. 2 intermediate level has been driven from a winze sunk upon the lode from the 100 feet level; it is 160 feet in length, nearly the whole of which was good ore, and has been stoped up to the No. 2 level.

At a vertical depth of 140 feet, the No. 3 level has been driven from the same winze for a distance of 25 feet north and 15 feet south, but no stoping has as yet been done.. The winze was then carried down for a further distance of 100 feet, making a total of 320 feet upon the plane of the lode.

With the object of cutting this reef at a depth a shaft was sunk upon the adjoining lease, G.M.L. 264D to the westward at a distance of 540 feet, which shaft has now reached a depth of 650 feet.

From this shaft a crosscut was driven at a depth of 250 feet for a distance of 200 feet east, in which two quartz veins were cut, both dipping to the westward but carrying only small values ; had this crosscut been carried on for another 40 feet it would in all probability have cut the Eureka lode, but owing to the fact that such a heavy supply of water was cut in this drive, which materially interfered with the shaft sinking, it was therefore dammed up.

At a depth of 400 feet a crosscut was driven east, which cut a quartz vein at a distance of 15 feet from the shaft; this was driven on for 15 feet north and 25 feet south. At 55 feet from the shaft in the same crosscut the Eureka lode, carrying values, was cut and driven on for a distance of 70 feet north, at which point a winze connects it with the 500 feet level. A little below this level the reef was cut in the shaft where it was three feet in width and assayed 3 ounces.

At a depth of 500 feet a crosscut was driven 110 feet west, which cut the Eureka lode, carrying values, at a distance of 45 feet from the shaft, and this was driven upon 130 feet south and 160 feet north.

In the north drive the reef, which varied from 1 foot to 18 inches in width, assayed upon the average from 30 to 35 dwts. of gold per ton for a length of 110 feet, some assays going as high as from 4 to 8 ounces. At a point about 40 feet north of the crosscut a winze was sunk upon the vein to a depth of 110 feet, the stone from which assayed between 5 and 6 dwts of gold per ton.

One hundred feet north of the crosscut another winze has been sunk to a depth of 45 feet, but in this the stone carried only very small values, whilst at the north face of the level the veins are cut off by a slide. At a point about 70 feet north of the crosscut a rise was put up to the 400 feet level, in which the stone carried values for the whole distance.

A crosscut was also driven at this level for a distance of 140 feet east of the shaft which cut a second body of quartz at a distance of 60 feet, and this was driven upon 150 feet north upon only low values.

At a depth of 650 feet a crosscut was driven for a distance of 110 feet east and 145 feet west, but the latter will have another 65 feet to go before it cuts the lode if this still continues upon the same dip.

It is most satisfactory to find that this reef is carrying values, although low, down to a depth of 600 feet since it is quite possible that much richer portions may be met with when the lode is further developed.

There is a winding engine, boilers, and compressor upon this mine and the remains of an old battery.

Table showing the yield of the Eureka Reef.

Year.	Name and Number of Lease.	Ore crushed.	Gold therefrom.	Rate per ton.
		Tons.	Ozs.	Ozs.
1897	Eureka No. 5 G.M.L. 26D	151.75	206.35	1.36
1898	Do.	215.00	207.49	.96
1899	Do.	582.50	617.74	1.06
1900	Do.	251.00	207.40	.82
1901	Do	80.00	53.51	.67
1906	East Fingall G.M.L. 264D ..	1,208.00	709.19	.58
	Total	**2,488.25**	**2,001.68**	1

The Creme d' Or, G.M.L. 389D.—A little to the southward of Eureka is an old mine which has been worked off and on for the 10 years; it is situated close to the railway station upon the eas side of the yard.

The reef strikes to the north-west and south-east with a di 55 degrees in the upper workings and 69 degrees in the winze.

The water level in this mine is 60 feet below the surface, and above this all the ore has been stoped for a length of 250 feet, but these old workings have now completely fallen in.

From the bottom of the old workings a winze has been sunk for a farther depth of 90 feet, in which the reef varies from 16 inches to 3 feet in thickness and assays from 32 dwts. to 2 ounces. In sinking this winze the country rock was schistose amphibolite, but a hard black dyke was found to pass through the reef which proved, upon microscopic examination, to be an augite andesite, thus belonging to the volcanic series.

A main vertical shaft has been sunk to a depth of 200 feet from the bottom of which a crosscut is being driven to the reef, which it is expected will be cut in a distance of 80 feet.

There is a small five head battery upon this mine besides a winding engine and pumps.

Table showing the yield of the Creme d'Or Reef.

Year.	Name and Number of Lease.	Ore crushed.	Gold therefrom.	Rate per ton.
Prior to—		Tons.	Ozs.	Ozs.
1897	Creme d' Or G.M.L., 22D	..	..	..
1897	Do.	21.50	17.40	.80
1898	Do.	134.00	80.27	.59
1899	Do.	61.00	46.12	.75
1900	Do.	26.50	23.38	.80
1903	Do. 330D	20.00	5.98	.29
1904	Do.	21.00	5.05	.23
1905	Do.	35.00	42.00	1.41
1906	Do. 389D	79.00	72.86	.92
	Total	**398.00**	**300.58**	**.75**

The New Ballarat, G.M.L. 241D.—Adjoining the Creme d' Or upon the south is a lease upon which a reef boldly outcrops, having a north-westerly strike for a length of 9 chains with a dip to the westward.

It has been worked from two or three shallow underlay shafts and a vertical shaft, from which 124 tons of stone were treated, which yielded 116.90 ounces of fine gold, equal to .94 ounces per ton.

The New Caledonia, or Last Chance, G.M.L. 244D (abandoned).—Upon the same line of country as the last, but about ¼ mile to the south-west of the town, are a series of old workings upon what ppears to have been a ferruginous decomposed outcrop about 8 ains in length, having a north-easterly course with a dip varying om 50 to 75 degrees to the westward, the vein being about 15 inches width in decomposed schistose country.

It was worked by opencuts and underlay shafts to the water el, the surface of which is said to have been very rich, from which ne 700 ounces of gold are reported to have been dollied in the ly days of the field when it was known as the Mullochy Leader, of this no official record exists.

Table showing the yield f the Last Chance Reef.

Year.	Name and Number of Lease.	Ore crushed.	Gold therefrom.	Rate per ton.
Prior to—		Tons.	Ozs.	Ozs.
1897	New Caledonia G.M.L., 157D	70.00	60.51	.86
1897	Do.	85.00	20.06	.23
1898	Do.	..	5.42	
1905	Last Chance G.M.L., 369D	111.00	41.93	.37
	Total	**266.00**	**127.92**	**.48**

The Caledonian, late Phoenix, G.M.L. 350D.—Still upon the same belt of country and almost adjoining to the southward is a reef which was worked as far back as 1894 by the Cue Victory G.M. Co., and later on by the Yalgoo Proprietary Syndicate.

The reef strikes in a north and south direction and underlays to the westward at an angle of 54 degrees, being of an average thickness of two feet six inches in schistose amphibolite country, the water level being 40 feet below the surface.

It has been worked by a main vertical shaft to a depth of 75 feet and four underlays to the water level, at which depth the reef has been driven for a distance of 130 feet.

It is reported that some 500 or 600 ounces of gold were taken from its cap in the early days before records were kept.

Table showing the yield of the Caledonian Reef.

Year.	Name and Number of Lease.	Ore crushed.	Gold therefrom.	Rate per ton.
Prior to—		Tons.	Ozs.	Ozs.
1897	Yalgoo Proprietary Prospecting Syndicate, Ltd., G.M.L., 12D	569.00	684.97	1.20
1897	Do.	97.00	90.25	.92
1898	Do.	54.00	31.00	.57
1899	Phœnix G.M.L., 173D ..	40.00	353.00	8.84
1900	Do.	..	254.00	..
1904	Caledonian G.M.L., 350D ..	..	12.51	..
	Total	**760.00**	**1,425.74**	**1.87**

Sailor Lad, G.M.L. (560) 134D (abandoned).—A little to the eastward of the Eureka No. 5 upon the side of the hill are some old workings which were known in the year 1898 as the Sailor Lad, the reef upon which strikes in a north and south direction and underl to the westward. It was worked by several shallow shafts and o cuts from which 48 tons of stone were raised, which yielded 5 ounces of fine gold, which is at the rate of 1.11 ounces per ton.

The Ironclad, late King Edward VII., G.M.L. 412D.—Almost mediately to the north of the last-mentioned are a line of old w ings upon a reef which strikes in a north-easterly direction and to the westward.

It was first worked as Edward VII., then as King Edward VII., but was again taken up last year as the Ironclad and Ironclad North.

Table showing the yield of the Edward VII. Reef.

Year.	Name and Number of Lease.	Ore crushed.	Gold therefrom.	Rate per ton.
		Tons.	Ozs.	Ozs.
1901	Edward VII. G.M.L. 214D	..	44.34	
1902	Do.	30.00	33.99	1.13
1903	King Edward VII. G.M.L. 322D	54.00	42.16	.78
1906	Ironclad G.M.L. 413D ..	47.00	4.33	.09
1906	Ironclad, North, G.M.L. 412D	50.00	36.22	.72
	Total	**181.00**	**161.04**	**.89**

The Kinsella, G.M.L. 179D.—Upon the southern point of a ridge about 1½ miles to the south-east of Day Dawn, is one of the oldest mines in this district; it is mentioned by Mr. Goczel in 1894, who states that at the time of his visit there were from "400 to 500 tons of promising looking stone at grass, and that the water level was 43 feet in vertical depth, the water being fresh"; this however has changed into salt at a depth.

As early as 1895 a 10-head battery was erected with other plant upon the ground to the value of £8,460; since that time, however, the property has changed hands several times, the machinery being augmented by the addition of another 10-head of stamps and a winding and pumping plant, the latter being capable of coping with the 80,000 gallons of water which this mine makes in the 24 hours.

The country in which the lode is enclosed is schistose amphibolite near the surface, but it is very solid and blocky below the water level, except near the fissure.

The reef has an outcrop of 27 chains in length, striking a little to the east of north and dipping to the eastward at an angle of 76 degrees in the pumping shaft between the No. 3 level and the surface whilst at the main shaft the reef goes down practically vertically to the No. 3 level, after which it flattens to an average dip of 58 degrees to the No. 4 level.

This reef has been tested from the surface by a number of shallow shafts and trenches, also by a whip shaft at the south end to the 100 feet level, a pump underlay shaft to the 170 feet level, and a main vertical shaft to a depth of 360 feet.

The main shaft is connected with all the levels, the No. 1 or 45 feet level being reached by a crosscut 30 feet in length, from which point the lode, which varies from 5ft. 6in. to 8ft. in thickness, was driven on for a distance of 255 feet north, 70 feet of which from either side of the pumping shaft being stoped up to the surface.

The south level in which the reef is about 6 feet in thickness ha been driven for a distance of 440 feet, ending at the whip shaft Above this level the ore has been stoped from a patch near th south end for a length of 120 feet, but only about 40 feet of thi has been carried up to the surface.

The No. 2 or 100 feet level is reached from the main shaft b a crosscut 45 feet in length, and from this point the lode has bee driven on north for a distance of 530 feet, the reef varying in siz from 3 feet at the north end to 15 feet 9 inches at the pumpin shaft and 4 feet at the main shaft. Only one stope 90 feet in lengt has been carried up to the No. 1 level upon the south side of th pumping shaft, but three other small stopes have been started whic total 170 feet in length.

The south level has been driven for a distance of 540 feet, th reef in which is, as a rule, small, starting with 4 feet at the mai shaft, then reducing to 3 feet at the No. 1 crosscut, and one foot a the Nos. 2 and 3, but increasing again to 3 feet at the south end o the level. A considerable quantity of underhand stoping has bee done from the No. 1 level but only three small stopes have bee started from this level, one 80 feet long near the whip shaft an two 60 and 30 feet respectively half way between it and the mai shaft.

The No. 3 or the 170 feet level is connected with the main shaf by a crosscut 33 feet in length and has been driven north for a distance of 310 feet, the reef in which varies from 8 feet near the mai shaft to 16 feet 6 inches at the bottom of the pump shaft, and 1 feet at the north end, but only a very small proportion has bee stoped near the main shaft. The south level is 340 feet in lengt and in it the reef increases in size from 8 feet at the shaft to 1 feet half-way along the drive, and decreases to 4 feet in the sout face. From this level a stope 270 feet in length has been carrie up to a height of 20 feet south from the main shaft. Between th Nos. 3 and 4 levels the shaft passed through the reef which at th point of intersection measured 16 feet in thickness, but at the 28 feet level where crosscut it had reduced in size to 9 feet. At thi level the reef was driven on for a length of 20 feet, but no stopin done.

Opening sets were put in the main shaft at a depth of 355 fee which is called the No. 5 level, but so far the crosscut to the ree has not yet been started.

A subsidiary parallel reef occurs to the westward of the mai reef, this has been prospected at the surface with fair results and has also been cut at one or two points in the lower workings by crosscutting.

Two inclined bores were put down to a vertical depth of 700 feet at an angle of 60 degrees from the western side of the reef, these would therefore follow more or less the cleavage planes of the rock which dip in that direction, and in consequence only one belt of country would be tested and further as the drills would have a tendency to sag they would eventually follow the cleavage planes of the rock.

A vertical bore was also put down upon the eastern side of the lode a little north of the main shaft, but since no particulars are to hand with regard to this bore the only conclusion that can be drawn is that it was unsatisfactory.

Although this is a large well-defined fissure reef and dips at a high angle it has so far proved to carry only low values, whilst these do not occur in, as far as can be determined, a definite shoot but in bunches or patches; nevertheless, when it is borne in mind that the stone averages from 6 to 8 feet in thickness and has yielded when crushed gold at the rate of 8dwts. per ton, there is every reason to hope that this mine may yet be worked at a profit.

Table showing the yield of the Kinsella Reef.

Year.	Name and Number of Lease.	Ore crushed.	Gold therefrom.	Rate per ton.
		Tons	Ozs.	Ozs.
Prior to— 1897	Kinsella G.M.L. 49D, 50D ..	7,312.00	3,207.90	.43
1897	Do.	192.50	80.94	.42
1898	Kinsella G.M.L. 27D, 149D	24.00	31.38	1.30
1899	Kinsella G.M.L. 27D, 149D	—	—	
1900	Kinsella G.M.L. 179D ..	106.50	66.86	.63
1901	Kinsella G.M.L. 179D ..	..	89.50	
1902	Kinsella G.M.L. 179D ..	—	—	
1903	Cue-Murchison Mining and Exploration Co., Ltd. 179D	1,773.00	594.33	.33
1904	Cue Murchison Mining and Exploration, Co., Ltd., 179D	291.00	40.82	.14
1904	Kinsella G.M.L. 179D ..	1,364.00	464.87	.34
1905	Do. do.	1,710.00	356.31	.20
1906	Do. do.	92.00	51.15	.55
	Total	**12,865.00**	**4,984.06**	**.38**

The Richman, G.M.L. 321D (abandoned).—This old mine which is now used as a fresh water supply is upon the top of a ridge about 1¼ miles east of Day Dawn; this is a long line of reef which outcrops for a length of 16 chains striking north-east and dipping to the westward. A large number of shafts have been sunk along it, the deepest of which are now used as wells. Only 70 tons of stone re reported to have been crushed from this lode, which yielded 82.78 ounces of fine gold, or at the rate of 2.61 ounces per ton.

Appendix I.

Registered Number.	Slide Number.	Name of Rock.	Locality.
		LIST OF CUE ROCKS.	
72	40	Chloritic schist ...	Cue
73	41	Hornblende andesite	Cue Hill
74	42	Do do	do
75	...	Blue quartz	Cue
76	347	Quartzite	do
77	43	Do	do
80	...	Lode-formation ...	Lady Mary Mine
82	...	Auriferous quartz ...	Salisbury Mine
84	45	Grano-diorite ...	Gem of Cue Mine
3796	258†	Do	Agamemnon Mine
3797	259†	Porphyry	Duke of York Mine
3798	260	Do	do
3799	261	Grano-diorite ...	Geo. Higginbotham Mine
3800	262	Chloritic schist ...	Red, White, and Blue Mine
3801	...	Quartz in chloritic schist	do do
3802	...	Quartz in grano-diorite	do do
3803	...	Grano-diorite ...	do do
3804	...	Amphibolite	do do
3805	...	Quartz and green mica	Victoria Mine
3806	...	Quartz	Campania Mine
3807	...	Do	Salisbury Mine
3808	...	Do	Real Mackay Mine
3809	...	Weathered basic dyke	do
3810	...	Decomposed felsite ...	New Volunteer Mine
3811	...	Grano-diorite ...	Cue One Mine, footwall, 230ft. level
3812	...	Do ...	Cue One Mine, hanging wall, 230ft. level
3813	...	Crushed basic dyke ...	Cue One Mine, parting in reef, 230ft. level
3814	...	Weathered porphyry	Duke of York Mine
3815	...	Quartz	Cue One Mine, 200ft. level
3816	...	Do	do 300ft. level
3817	...	Ironstone	Princess Extended Mine
3818	...	Hornblende andesite	Cue Hill
3820	...	Amphibolite	Rose of England Mine
3821	...	Do	do
3822	...	Felsite	do
3823	263†	Hornblende andesite	New Princess Extended Mine
3824	...	Amphibolite	May Bell Mine
3829	...	Gabbro	Hill between Lady Forrest and Polar Star
3832	267†	Do	Hill between Lady Forrest and Polar Star
3833	268	Epidiorite	Queenslander Mine
3834	...	Weathered greenstone	Recreation Reserve
3835	269	Epidiorite	Polar Star Mine
3842	...	Epidiorite	Water Reserve 7748
3845	...	Porphyry	Near G.M.L. 653
3846	...	Epidiorite	Water Reserve 7748
3847	271†	Do	do do

† Analysed. *See* page 53.

APPENDIX I.—*continued.*

Registered Number.	Slide Number.	Name of Rock.	Locality.
		List of Cue Rocks—*continued.*	
3874	...	Porphyry	Mitcham Mine
3875	...	Do	do
3876	...	Do	Normanby Mine
3877	...	Quartzite	Near Racecourse
3878	...	Grano-diorite ...	Homeward Bound Mine
3880	275	Epidiorite	Cue and Day Dawn Road
3881	276	Amphibolite	Lady Forrest Mine
3882	...	Epidiorite	Homeward Bound Mine
3883	...	Do	Cue-Day Dawn Road
3884	...	Do	do
3887	...	Laterite	Rifle Range
3888	...	Ironstone vein ...	Fleur de Mai Mine
3889	...	Ironstone vein conglomerate	do
3890	...	Grano-diorite ...	Light of Asia Mine
3891	...	Quartz	Light of Asia Mine 295 ft. level
3892	...	Serpentine schist ...	Catalpa Mine
3893	...	Quartz	do
3894	...	Amphibolite	Rifle Range
3897	...	Quartz	do
4586	751	Amphibolite	Bores at Cue near Volunteer Group, depth 486 ft.
4586	752	Grano diorite ...	Bores at Cue near Volunteer Group, depth 999 ft.
4586	297	Do	Bores at Cue near Volunteer Group, depth 536 ft.
4586	334	Do	Bores at Cue near Volunteer Group, depth 823 ft.
4586	335	Chloritic schist ...	Bores at Cue near Volunteer Group, depth 960 ft.
6850	...	Grano diorite ...	Argus Mine
6851	...	Felspar-porphyry (weathered) ...	Lombardy Mine
6852	...	Amphibolite with pyrites	do
6853	...	Amphibolite with calcite	do
6854	...	Quartz with calcite ...	do
6855	...	Lode mattern with pyrites	do
6856	...	Felspar porphyry ...	Gem Mine
6857	...	Do ...	Red, White, and Blue Mine
6858	719†	Epidiorite	do
6859	...	Amphibolite with pyrites	do
6860	...	Chloritic schist ...	do
6861	...	Felspar porphyry ...	do
6862	749	Amphibolite	Strathmore Mine
6863	...	Weathered schist ...	Two Nations Mine
6864	...	Quartzite	M.H.L. 10
6865	...	Do	do
6866	...	Felspar porphyry ...	Polar Star

† Analysed. *See* page 58.

APPENDIX I.—*continued.*

List of Cue Rocks—*continued.*

Registered Number.	Slide Number.	Name of Rock.	Locality.
6867	...	Felspar porphyry ...	Polar Star
6868	...	Felspar porphyry (schistose) ...	do
6869	...	Do ...	do
6870	720†	Epidiorite	do
6871	750	Do	do
6872	...	Diorite	Homeward Bound Mine
6873	...	Epidiorite	do
6874†	721	Do	do
6875	...	Felspar porphyry ...	Victoria Mine
6876	...	Kaolin	Lily North Mine
6877	...	Felsite (weathered)	do
6878	...	Grano-diorite ...	Lily Mine
6879	...	Felspar porphyry ...	do
6880	734†	Oligoclase pegmatite	Near Lily Mine
6881	...	Hematite	do
6882	...	Felspar porphyry ...	Jubilee Mine
6883	725	Grano-diorite ...	Countess Mine
6884	...	Do	do
6885	722†	Do	do
6886	...	Calcite	do
6887	...	Felspar porphyry ...	Belgravia Mine
6888	723	Do ...	Old Francis Mine
6889	...	Maganese	Princess Royal Mine
6890	...	Vein stone	do
6891	...	Epidiorite	do
6892	...	Felsite (weathered)...	Caledonia Hill Mine
6893	...	Felspar porphyry ...	do
6894	724	Do ...	Duke of York
6895	...	Do ...	do
6896	...	Bored rock	Cue Victory Mine
6897	...	Amphibolite (weathered)	Rifle Range
6898	...	Hematite	Pension Mine
6899	...	Limonite	Near Rose Mine
7307	758	Hornblende andesite	Ridge East of Cue Hill
7308	...	Jasper with common opal	Cue Hill
7309	760	Amphibolite	do
7310	759	Do	Cue Rifle Range
7311	...	Do	Ridge East of Cue Hill
7312	...	Epidiorite	Western boundary of town
7313	757	Porphyry	do do
7314	...	Epidiorite	Between Lady Forrest an Polar Star Mines
7315	...	Crushed Grano-diorite	530ft. level, Cue One Mine
7316	...	Do ...	do
7317	...	Segregation in diorite	Lady Mary Mine

LIST OF CUDDINGWARRA ROCKS.

Registered Number.	Slide Number.	Name of Rock.	Locality.
6903	729	Felspar porphyry ...	Hill, west of town
6904	...	Do	do

---

† Analysed. *See* page 53.

APPENDIX I.—*continued.*

Registered Number.	Slide Number.	Name of Rock.	Locality.
		LIST OF CUDDINGWARRA ROCKS—*continued.*	
6905	...	Felspar porphyry ...	G.M.L. 1078
6906	730	Do	Near Golden Fleece Mine
6907	731	Do	Near Treasure Trove Mine
6908	732	Do	City of Chester Mine
6909	733	Do	Victory United Mine
6910	...	Schistose amphibolite	do
6911	...	Do ...	do
6912	...	Felsite	Golden Gate Mine
		LIST OF DAY DAWN ROCKS.	
78	46	Felspar porphyry ...	Near Trenton Mine
83	44	Epidiorite	Trenton Mine
85	...	Halloysite	Day Dawn
3825	...	Porphyry	260 M.P. railway line
3826	264	Weathered amphibolite	Explosive Reserve
3827	...	Greenstone schist ...	do
3828	265	Epidiorite	Near Bonnie Scotland Mine
3836	...	Amphibolite	RubiconMine, No. 2 lode, 100ft. level
3837	...	Greenstone Schist ...	Rubicon Mine, No. 1 lode, 100ft. level
3838	...	Quartz	Rubicon Mine, No. 1 lode, 100ft level footwall
3839	...	Carbonate of Copper	Rubicon North
3840	...	Cupriferous gold ore	do
3879	...	Chloritic schist ...	Crœsus Mine
3830	266	Do	White Horse Mine
3831	...	Quartz	do
3841	...	Hornblende	Rubicon North
3844	...	Chloritic schist ...	Emperor Mine, 200ft. level
3848	...	Amphibolite	West Fingall, 150ft. level
3849	...	Mica-Chloritic schist	Gt. Fingall No. 7, 120ft. level water shaft
3850	...	Chloritised amphibolite	Golden Crown Mine, 225ft. level, 30ft. W. crosscut
3851	...	Do	Golden Crown Mine, 225ft. level, 130ft. crosscut
3852	...	Chloritic schist ...	Golden Crown Mine, 225ft. level, 35ft. N.E. crosscut
3853	...	Foliated amphibolite	Golden Crown Mine, 225ft. level, 150ft. N.E. crosscut
38[illegible]4	...	Crushed do	Golden Crown Mine, 225ft. level, 175ft. N.E. crosscut
38[illegible]5	...	Do do	Golden Crown Mine, 225ft. level, 215ft. N.E. crosscut
38[illegible]	272	Epidote rock ...	Golden Crown Mine, 150ft. level, 20ft. from shaft
38[illegible]	...	Chloritised amphibolite	Great Fingall, 540ft. level
38[illegible]	274	Chloritic schist ...	do do

APPENDIX I.—*continued.*

Registered Number.	Slide Number.	Name of Rock.	Locality.
		List of Day Dawn Rocks—*continued.*	
3859	..	Quartz	Great Fingall, 640ft. level
3860	...	Amphibolite	do do
3861	...	Quartz	do do
3862	...	Crushed amphibolite	do 540ft. level
3863	...	Do	do do
3864	...	Do	do do
3865	...	Graphitic schist ...	do do
3866	...	Do	do do
3867	...	Amphibolite with iron pyrites	do do
3868	...	Amphibolite with iron pyrites	do do
3869	...	Amphibolite with iron calcite	do do
3870	...	Weathered amphibolite	do 80 ft.
3871	...	Weathered amphibolite	do do
3872	...	Graphitic schist ...	do do
3873	...	Do do ...	do do
3885	...	Mica-chloritic schist	Little Wonder Mine
3886	277†	Porphyry	do do
3895	...	Amphibolite	G.M.L. 336
3896	...	Do	Creme d'Or Mine
3898	...	Tourmaline in Amphibolite	Emperor Mine
3951	273	Amphibolite	Great Fingall
3952	278	Epidiorite	Little Wonder Mine
3976	†	Felspar porphyry ...	G.M.L. 226D
6900	726	Hornblende andesite	Trenton Hill
6901	727	Do do	do
6902	...	Felspar porphyry ...	Rifle Range
6973	725†	Augite andesite ...	Creme d'Or Mine
6974	...	Chloritic schist with graphite	No. 9 level, Great Fingall Min

† Analysed. *See* page 53.

Appendix II.

NOTES ON SOME TYPICAL CUE ROCKS.

By Edward S. Simpson, B.E., F.C.S., Mineralogist and Assayer.

Sub-acid Rocks.—No true acid granites or their offshoots appear amongst the Cue rocks in the collection, the most acidic rocks are a grano-diorite from a large intrusive mass and sundry dyke rocks of the same magmatic type.

[3976.] *Grano-diorite, Agamemnon, G.M.L.* 1047.—A coarse grey granitoid rock. In hand specimens quartz, felspar, hornblende and biotite are readily distinguished and the rock would naturally be looked upon as a granite. The analysis, however (in the accompanying table), shows that the silica percentage is low for such a rock, being only 63, whilst a calculation shows that the ratio orthoclase to albite to anorthite would be 1 to 5 to 2 under ideal conditions of crystallisation. Under the microscope the rock appears to have a typical coarse granitic structure. The chief constituents are: plagioclase, very slightly clouded, frequently multiply twinned, often exhibiting a zonal structure.* Orthoclase, a few large singly-twinned crystals. Quartz, this is the most important constituent after plagioclase. Hornblende is plentiful in large well defined crystals, frequently twinned. Biotite is as common as hornblende, and is developed in coarse ragged-edged masses.

This grano-diorite encloses dark fine grained segregations, the boundaries of which are sharply defined though not marked by any plane of cleavage. A section through the junction in specimen [6883] from Countess, G.M.L. 1066, emphasises the fact of there being no dividing line, coarse crystals on one side being interwoven with finer crystals on the other. The segregation appears to be composed of the same minerals as the coarse rock in similar proportions. The dark colour to the unaided eye being due to the more general distribution of fine crystals of hornblende and biotite. No analysis has been made of an unaltered segregation.

[6885.] *Grano-diorite segregation, Countess, G.M.L.* 1066.—This segregation, which is extremely fine grained and of a dark greenish grey colour, has evidently been metamorphosed. In a hand specimen traces of foliation are apparent, whilst the analysis shows the presence of a considerable amount of carbonic acid, combined water and pyrites. Apart from these added constituents the rock agrees very closely with the coarse grano-diorite in composition. Under the microscope it is seen to be a finely granular mixture of felspar, quartz, hornblende, calcite, mica, and a little pyrites. It has the appearance of having been much crushed.

Three dyke rocks of the grano-diorite type have been analysed with the results shown in the table attached; they are numbered [3797], [3976], and [6880].

[3797.] *Quartz-mica Porphyry, Duke of York, G.M.L.* 1287.—This is a grey rock with crypto-crystalline base and abundant phenocrysts of biotite. A closer inspection reveals numerous grains of quartz and occasional crystals of felspar. An analysis of this rock is given in the accompanying table. Though more siliceous than the main mass of grano-diorite, the relative proportions of the various felspar molecules as well as the mineral constitution of the rock lead one to class it with the grano-diorite, bearing in mind that narrow offshoots of such rocks are likely to differ somewhat in composition from the main mass and are usually more siliceous. Under the microscope the rock is seen to consist of a very finely granular base in which are embedded numerous phenocrysts. The most common of these is quartz with somewhat less numbers of biotite and felspar. The felspar is mostly untwinned; one crystal however showed single twinning.

[3976.] *Felspar Porphyry, G.M.L.* 226.—A fine grained grey rock in which the porphyritic structure is not very evident. It is a bore core from a depth of 2,030 feet. It appears to have been crushed, and the analysis shows that considerable alteration has taken place in it. It is less acid than the porphyry previously described and approaches very closely the grano-diorite in composition. Under the microscope it is seen to be composed of small grains of varying size of felspars, quartz, hornblende, biotite, and iron ores. Owing to the variable size of the components the porphyritic structure is not very evident but large crystals of felspar, some at least plagioclase, are present. There is every indication of the rock having been crushed considerably.

[6880]. *Oligoclase Pegmatite, West of Lily, G.M.L.* 1494.—This interesting rock is pale greenish grey in colour, and finely granular. It weathers with a brown, much pitted surface like a limestone. Its analysis, shown in the table, indicates its relationship to the grano-diorite. Calculation would point to the existence in it of somewhere about 70 per cent. of oligoclase. A section shows it to be composed mainly of a single felspar, oligoclase, in fairly coarse grains. Numerous crystals of a yellow epidote are also present.

Basic Rocks.—Four types of these have been analysed, the first of which belongs to a large mass, two others are from small dykes, whilst the fourth appears to represent a surface lava flow.

[6858]. *Quartz diorite (Epidiorite?) Red, White and Blue, G.M.L.* 745.—This is a green rock of medium grain in which hornblende, felspar, and some quartz are all visible to the unaided eye. The felspar is occasionally porphyritic. Judging by its chemical composition this rock has not been subject to any great chemical change as a whole. Internal rearrangement of the constituents may have taken place, however, and the hornblende and quartz are both very possibly secondary, in which case the rock is not a true diorite ut an epidiorite. A thin section shows that green and yellow hornblende and cloudy plagioclase are about equally abundant. In neither case are the crystal boundaries very sharply defined. Quartz is fairly frequent and is never idiomorphic.

[6870]. *Epidiorite, Polar Star, G.M.L.* 1277.—This rock is very similar in hand specimens to [6353] except that it is distinctly coarser in grain and the tendency of the felspar to form occasional larger crystals more apparent. There is no appearance of foliation, and the analysis shows that carbonic acid and combined water are almost absent. The most notable feature of the analysis is the very large percentage of alumina present. The amphibole present is probably therefore of the highly aluminous variety, edenite. In respect of the high proportion of alumina this rock differs essentially from [6858] and closely resembles [6374] and [3847] described below. In thin section it is seen to contain a large proportion of fibrous and ragged amphibole which is quite colourless, except for one or two small portions of crystals which are pale green. Two felspars are abundant. One very much clouded and showing no signs of twinning, the other perfectly clear and multiply twinned. This is probably secondary albite. The rock is evidently a highly metamorphosed intrusive.

[6874]. *Epidiorite, Homeward Bound, G.M.L.* 1211.—This rock is rather coarse grained and greenish grey in colour. Felspar and amphibole are readily perceived in hand specimens. In composition it is practically identical with [6870]. Under the microscope the colourless or almost colourless amphibole (edenite?) is plainly seen to be secondary, the masses of it being very fibrous or composed of a felted mass of minute spicules. Original felspars are represented by much-clouded areas, but newer felspar, very clear and multiply twinned, is one of the most important constituents. A little iron ore is present.

[3847]. *Epidiorite schist, Water Reserve* 7745.—This is a coarse-grained rock of the same type as the two previously described but the arrangement of the amphibole crystals gives a banded appearance to the rock. In composition it agrees also with [6870] and [6874]. Under the microscope it is seen to be composed of coarse grains of much-clouded felspar and pale fibrous amphibole. No quartz and only a very little secondary felspar was observed.

[3832]. *Gabbro,* north side of hill between *Lady Forrest, G.M.L.* 1051, and *Polar Star, G.M.L.* 1277.—This rock was proisionally classed as a norite in Bulletin No. 14, but a detailed xamination shows that it is to be classed as a gabbro, the chief erro-magnesian constituent being diallage. In chemical composiion it is very like the quartz diorite [6858]. It is a coarse-grained rownish black rock which, under the microscope, is seen to be very esh and free from alteration, uniformly coarse-grained, and comsed of about equal proportions of plagioclase and diallage. The ter in sections approximately vertical, is pale green with numers parallel strings of inclusions, non-pleochroic and having a large extinction angle. In sections approximately basal it is strongly pleochroic, pale green, changing to bright brownish pink, and possessing typical cleavage. The felspar is very fresh and multiply twinned. A very little hornblende and iron ore are present.

[6973]. *Augite Andesite, Creme d'Or, G.M.L.* 389D.—This is a very fine-grained black rock in which small spicules of felspar only are clearly visible to the unaided eye. Under the microscope it is seen to be composed of a fine-grained base of augite and iron ore, the latter largely dendritic, and in this base are embedded numerous larger crystals of perfectly transparent multiply twinned plagioclase. Augite phenocrysts also occur somewhat frequently. No olivine or glass could be detected.

[73] and [3823]. *Hornblende Andesite*, near Trig Hill.—This is a dark green aphanitic rock which in hand specimens has every appearance of being part of a lava flow. It has a subconchoidal fracture with indications of flow structure in places, and in others a pseudo-brecciated structure, as if portions of the rock had solidified and then been resubmerged in the still molten portion. In composition it is not very similar to any other of the rocks examined. Under the microscope it is seen to be composed very largely of fine-grained green hornblende with felspar both in the fine ground mass and in lath-like porphyritic crystals, the latter are very fresh looking and have a rough parallelism. No glass or iron ores are apparent.

G.S.L. No. ...	2168B	6880 3089B	6874 3088B	6885 3090B	3796 3836A	3832 3851A		3976 3953A	3823 3861A	3847 3849A	6870 2114B	6858 2150B	6973 3404B
Name ...	Quartz-mica Porybyry.	Oligoclase Pegmatite.	Epidiorite.	Dark Segregation in Namodiaite, somewhat foliated.	Coarse Granodiorite.	Gabbro.		Felspar Porphyry.	Hornblende Andesite.	Epidiorite Schist.	Epidiorite.	Quartz diorite (Epidiorite ?)	Augite Andesite.
Locality	Duke of York G.M.L. 1287.	W. of Lily G.M.L. 1494.	Homeward Bound G.M.L 1211.	Countess G.M L. 1066.	Agamemnon G.M.L. 1047.	N. side of Hill, bet. Lady Forrest and Polar Star G.M.Ls.		2090ft. D.D.B. G.M.L. 226	9 chs. S. of Princess Extended G.M.L. 1232.	Water Reserve. 7745.	Polar Star G.M.L. 1277.	Red, White, and Blue G.M.L. 745.	Cremed'Or G.M.L. 389.
SiO_2	74·86	66·43	46·27	57·25	63·62	50·12	SiO_2	68·46	48·10	48·09	46·44	52·31	50·80
TiO_2	·13	·68	·49	·52	·72	·26	TiO_2	·61	·41	·12	·42	·41	2·49
CO_2	·03	*Nil*	·25	5·21	*Nil*	·03	CO_2	2·00	·12	·12	·24	·05	·29
P_2O_5	·15	·40	·11	·23	n.d.	n.d.	P_2O_5	n.d.	n.d.	n.d.	·36	·31	·68
H_2O comb. ...	·13	·26	1·17	1·05	·06	·03	H_2Ox	·83	·33	2·05	·06	·88	·93
K_2O	3·07	·35	·13	2·90	1·20	·08	K_2O	2·05	·14	·07	·10	·59	1·56
Na_2O	4·33	6·35	1·52	2·19	4·40	1·95	Na_2O	4·01	2·11	2·17	1·05	2·57	2·41
CaO	1·18	5·88	14·69	6·49	5·43	13·04	CaO	2·63	12·73	11·30	15·18	9·32	8·31
MgO	·42	1·60	6·65	2·88	3·13	10·00	MgO	2·08	6·38	7·56	9·19	8·90	4·61
MnO	·19	*Nil*	·32	·23	·28	·29	MnO	trace	·05	·29	·22	·29	·09
FeO	·36	1·17	3·51	3·51	3·47	7·01	FeO	3·20	4·33	6·99	3·99	5·87	12·13
Fe_2O_3 ..	1·12	·54	1·36	·84	3·29	1·66	Fe_2O_3	2·27	10·32	1·43	1·91	3·09	2·91
Al_2O_3 ...	14·01	16·22	23·85	14·65	14·38	14·90	Al_2O_3	12·25	15·41	19·77	20·22	14·64	11·63
FeS_2	·04	·04	·08	·95	*Nil*	·13	FeS_2	·15	·25	·11	·20	·02	·26
H_2O Hyg. ...	·24	·20	·11	·12	·22	·13	H_2O-	·05	·04	·17	·18	·25	·71
Total ...	100·26	100·12	100·71	99·02	100·20	99·63	...	100·59	100·92	100·24	99·76	99·50	99·81
Calcd. Orthoc.	18·35	1·95	...	17·24	7·23	·45	...	11·68	·78	...	·56	3·34	9·17
,, Albite	36·68	53·71	...	18·34	37·20	16·34	...	34·06	17·82	...	8·91	22·01	20·44
,, Anorth.	5·84	15·01	...	21·41	15·85	31·69	...	9·45	32·25	...	50·04	26·41	16·40
Excess CaO .	(Al_2O_3 2·14)	2·85	...	2·20	...	...	...	·65	6·25	...			
Sp. Gr. ...	2·63	2·70	2·90	2·70	2·76	3·02	...	2·74	3·11	2·98	3·03	3·00	2·96
Analyst ...	E S.S.	C.C.W.	J.H.B.	C.C.W.	E.S.S.	E.S.S.	...	C.C.W.	C.C.W.	C.C.W.	J.H.B.	E.S.S.	C.C.W.
No. of Section	259	734	721	722	258	267	...	286/7	263	271	720	719	728

Index to Names of Persons, Places, Mines, Reefs, etc.

Page

Ada Mary Mine ... ii., 14, 31
Agamemnon Mine ... i., 66, 74; ii., 44, 49, 53
Amy Florence Mine ... i., 81, 92
Analysis of Rocks ... ii., 53
Anglo-Saxon Mine ... i., 39
Arcadia Mine ... i., 14, 55, 74
Arcadia North Mine ... i., 56, 74
Argus Mine ... i., 31, 74; ii. 45
Ashbourne Mine ... i., 56, 74
Aurifer Mine ... ii., 14, 31
Austin's Lake ... i., 80; ii. 7

Battler's Hope Mine ... i., 33, 74
Bedford Mine ... i., 56, 74
Belgravia Mine ... i., 37, 74; ii., 46
Belgravia Central Mine ... i., 38, 74
Bewick, Moreing & Co. ... i., 50; ii., 22
Black Swan Mine ... i., 81, 84, 90
Blue Bell Mine ... i., 81, 85, 86
Blue Bell Proprietary ... i., 81, 87
Bonanza Mine ... i., 81, 91
Bonnie Scotland Mine ... ii., 14, 36
Brilliant Mine ... i., 35, 74
Buttercup Mine ... i., 34, 74

Caledonia Mine ... ii., 14, 40
Caledonia Hill Mine ... i., 48, 74; ii., 46
Campania Mine ... i., 38; ii., 44
Campbell, Mr. W. D. ... i., 5, 24
Catalpa Mine ... i., 69, 74; ii., 45
Catalpa South Mine ... i., 74
Chesson, Mr. ... i., 24, 44, 47
City of Chester Mine ... i., 81, 84, 85; ii., 47
City of St. Petersburg Mine ... i., 28, 74
City of Sydney Mine ... i., 81, 84, 86
Comforter Mine ... i.. 52, 73
Commonwealth Mine ... i., 57
Conscript Mine ... i.,52, 73
C solidated Murchison G.Ms. Ltd. ... ii., 15, 28, 43
C ya Mine ... ii.,14, 23
C ntess Mine ... i., 55, 74; ii., 46, 49, 53
C ntess Extended Mine ... i., 55, 74
C me d'or Mine ... ii., 9, 13, 14, 38, 48, 52, 53
C sus Mine ... ii., 6, 11, 14. 27, 47
C ldingwarra ... i., 12, 16, 80; ii., 8
C dingwarra Gold Mines, Ltd. ... i., 88
C ... i., 7; ii., 7, 8, 44
C Consolidated G.M., Ltd. ... i., 43, 47, 74
C Fingall Mine ... i., 72, 74

Page
Cue Hill ... i., 7, 16, 17, 23, 43; ii., 44, 46
Cue Homeward Bound Mine ... i., 73, 74
Cue Mining and Exploration Coy. ... ii., 14, 24
Cue Mine ... i., 39
Cue Mt. Tom ... i., 8
Cue No. 1 Mine ... i., 8, 14, 20, 21, 43, 50, 74; ii., 44, 46
Cue Victory ... i., 57, 75; ii., 46

Day Dawn District ... ii., 8
Day Dawn Mine ... i., 12; ii., 7, 13, 14, 15, 23, 32, 47
Day Dawn North Mine ... ii., 15, 23
Day Dawn South Mine ... ii., 15
Day Dawn West Mine ... ii., 6, 12, 15, 28, 29
Dead Finish ... i., 80
Deceiver Mine ... i., 35, 75
Deceiver North Mine ... i., 35, 75
Duchess Mine ... i., 70, 75
Duke of York Mine ... i., 26, 65, 75; ii., 44, 46, 50, 53
Duke of York Deeps Mine ... i., 65, 75
Duke of York Extended Mine ... i., 65, 75

Easter Monday Mine ... i., 72, 75
East Fingall Mine ... ii., 5, 6, 14, 37
Eclipse Mine ... i., 61, 75
Edward VII. Mine ... ii., 14, 41
Edwards, Mr. ... i., 8, 43
Emily Mine ... i., 81, 92
Emperor Mine ... i., 12; ii., 6, 14, 33, 47, 48
Eureka No. 5 Mine ... ii., 13, 14, 37

Fairlight Mine ... i., 81, 84, 87
Fingall Deeps ... ii., 29
Fingall Extended ... ii., 33
Fingall Mine ... ii., 14, 23
Fingall Proprietary, Ltd. ... i., 88
Fleur de Mai Mine ... i., 68; ii., 45
Fortune of War Mine ... i., 81, 89
Francis Mine ... i., 37

Gem Mine ... i., 31, 75; ii., 45
Gem of Cue Mine ... i., 61, 75; ii., 44
Gem of Cue Extended Mine ... i., 60, 75
Gem of Murchison Mine ... i., 31, 75
Genge, Mr. Isaac ... i., 85
George Higginbotham Mine ... i., 30, 75; ii., 44
Gibraltar Mine ... i., 67
Göczel, Mr. S. ... i., 11, 24, 39, 80, 86; ii., 8, 41
Golden Crown Mine ... ii., 12, 14, 15, 28, 29, 30, 47
Golden Crows Nest Mine ... i., 60, 75
Golden Fleece Mine ... i., 81, 84, 92
Golden Garter Mine ... i., 52, 75
Golden Gate Mine ... i., 81, 84, 87; ii. 47
Golden Gem Mine ... i., 31, 75
Golden Leaf Mine ... i., 33, 75
Golden Ridge Mine ... ii., 31
Golden Stream Mine ... i., 57
Golden Stream Extended Mine ... i., 58, 75
Golden Stream North Extended Mine ... i., 59, 75
Great Fingall Associated Mine ... ii., 14, 23

Page

Great Fingall Consolidated Mine ... i., 5; ii., 5, 6, 7, 12, 13, 14, 15, 28, 29, 47, 48
Great Fingall North Mine ... ii., 23
Great Western Mine ... ii., 14, 31
Great White Eye Mine ... i., 66, 75
Greymouth Mine ... i., 81, 85, 90
Groper Mine ... ii., 14, 25

Happy Jack Mine ... i., 69, 75
Hard Luck Mine ... i., 27, 75
Hard Nails Mine ... i., 29, 75
Harp of Erin Mine ... i., 8
Hayden, Mr. ... i., 24, 44, 47
Heart of Oak Mine ... i., 55, 75
Heffernan, Mr. ... ii., 7, 15
Highland Mary Mine ... i., 33, 75
Homeward Bound Mine ... i., 73, 75; ii., 45, 53, 46, 51
Hoskins, Capt. ... ii , 5, 24

Independent Mine ... i., 31, 75
Ironclad Mine ... ii., 14, 40
Ironclad North Mine ... ii., 14, 41
Ivy Mary Mine ... ii., 14, 31

Jackson, Mr. ... i., 8
Jewett, Capt. ... ii., 5
Jubilee Mine ... i., 32, 75; ii., 46

Kallara Mine ... i., 81, 84
Kangaroo Mine ... i., 28, 76
King Edward VII. Mine ... ii., 14, 40
Kinsella Mine ... ii., 6, 13, 14, 41
Klondyke Mine ... ii., 14, 31

Lady Florence Mine ... i., 42
Lady Forrest Mine ... i., 71, 76; ii., 45
Lady Godiva Mine ... i., 28, 76
Lady Hynes Mine ... i., 59, 76
Lady Kintore Mine ... i., 8
Lady Mary Mine ... i., 8, 12, 14, 42, 45, 46, 76; ii. 44, 46
Lady Mary No. 1 South ... i., 43, 76
Lady Rosie Mine ... i., 81, 84, 91
Last Chance Mine ... ii., 14, 39
Laura Mine ... i., 81, 87
Le Premier Fleur de Mai Mine ... i., 68, 76
Leviathan Mine ... i., 29, 76
Light of Asia Mine ... i., 14, 46, 62, 76; ii., 45
Lily Mine ... i., 35, 76; ii., 46
Lily North Mine ... i., 37, 76; ii., 46
Lily North Extended Mine ... i., 37, 76
Lily No. 2 South Mine ... i., 36, 76
Little Gem Mine ... i., 31, 76
Little Sparkler Mine ... i., 34, 76
L ttle Wonder Mine ... ii., 48
L oyd, Mr. E. ... i., 24, 61
L ombardy Mine ... i., 32, 76; ii., 45
L ouis, Mr. H. ... i , 12
L vell, Mr. G. ... ii.

Page
Mafekin Mine ... i., 27, 76
Maori Mine ... i., 39, 76
Maori Chief Mine ... i., 76
Marvel Mine ... i., 69, 76
Maude Mine ... i., 40, 76
Maybell Mine ... i., 69, 76; ii., 44
McDermott, Mr. ... i., 70
Mikado Mine ... ii., 14
Mitcham Mine ... ii., 45
Monte Carlo Mine ... i., 28, 76
Monteith, Dr. ... i., 46
Moonlight Mine ... i., 81
Mt. Fingall Mine ... ii., 6, 11, 14, 31
Murchison Associated Mines ... i., 72, 76; ii., 5, 14, 25, 27
Mystery Mine ... i., 59, 76

New Arcadia Mine ... i., 56, 77
New Arcadia North Mine ... i., 56, 77
New Arcadia North Extended Mine ... i., 56, 77
New Ballarat Mine ... ii., 14, 39
New Caledonia Mine ... ii., 14, 39
New Eclipse Mine ... i., 62, 77
New Eldorado Mine ... i., 60, 77
New England Mine ... i., 39, 77
New Fingall Mine ... ii., 14
New Gem of Murchison Mine ... i., 31, 77
New Leviathan Mine ... i., 30, 77
New North Cue Mine ... i., 65, 77
New Princess Extended Mine ... ii., 44
New Venture Mine ... i., 53, 77
New Volunteer Mine ... i., 52, 77; ii., 44
New Volunteer Extended Mine ... i., 52, 77
Nil Desperandum Mine ... i., 60, 77
Nimrod Mine ... ii., 14, 27
Normanby Mine ... i., 64, 77; ii., 45
North Bismark ... i., 68, 77
North Victoria Mine ... i., 35, 77
North Volunteer Mine ... i., 77

Old Francis Mine ... i., 37, 77; ii., 46
Old Princess Ada Mine ... i., 51, 77
Olive Mine ... i., 68, 77
O'Neil, Mr. ... i., 8
Ophir Mine ... i., 62, 77
Oxonian Mine ... i., 81, 92

Patch, the ... i., 8, 19, 21, 51
Pead, Mr. ... i., 8, 43
Pearling Ground ... i., 8, 22
Pension Mine ... i., 68, 77; ii., 46
Pelican Mine ... ii., 14, 15, 29
Perseverance Mine ... i., 60, 77; ii., 14, 30
Phœnix Mine ... i., 8; ii., 14, 40
Polar Star Mine ... i., 72, 77; ii., 44, 45, 51, 53
Prendergast, Mr. ... i., 8
Princess Ada Mine ... i., 14, 46, 50, 77
Princess Ada South Mine ... i., 50, 77
Princess Leases ... i., 1, 77
Princess Extended Mine ... ii., 1, 53

Page
Princess Consolidated Murchison ... i., 70, 77
Princess Royal Mine ... i., 70, 77; ii., 46

Queen's Birthday Mine ... ii., 14, 29
Queen of the May Mine ... i., 63, 77
Queenslander Mine ... ii., 44

Real McKay Mine ... i., 38, 78; ii., 44
Red, White, and Blue Mine ... i., 14, 15, 33, 78; ii., 44, 45, 50, 53
Reece, Mr. Frank ... i., 24
Republic Mine ... i., 58, 78
Research Mine ... i., 38, 78
Retreat Mine ... i., 26, 78
Revenue Mine ... ii., 14
Rheingold Mine ... i., 81, 85, 90
Richmond Mine ... ii., 14, 43
Rising Sun Mine ... i., 8, 46, 47, 78
Rising Sun North Mine ... 47, 48
Rocks, List of ... ii., 44
Rose Mine ... i., 68, 78, 81, 92
Rose of England Mine ... i., 78; ii., 44
Royal Charter Mine ... ii., 14, 25
Royal Mint Mine ... i., 81, 92
Royal North Mine ... i., 38, 78
Royal Secret Mine ... i., 70, 78
Rubicon Mine ... ii., 6, 11, 25, 47

Sailor Lad Mine ... ii., 14, 40
Salisbury Mine ... i., 20, 21, 40, 78; ii., 44
Salepta Mine ... i., 68, 78
San Diego Mine ... ii., 27
Schmeisser, Herr Karl ... i., 12
Scotia Mine ... i., 81, 88
Simpson, Mr. E. C. ... i., 5
Smith's United Mine ... ii., 14, 15, 30
Southdown Mine ... ii., 14, 31
South Victory Mine ... i., 81, 84, 92
South Volunteer Mine ... i., 53, 78
St. Albans Mine ... ii., 14, 15, 30
Stanmore Mine ... i., 27, 78
Starlight Mine ... i., 54, 78
Star of Asia Mine ... i., 60, 78
Star of Hope Mine ... i., 60, 78
Stern's Mine ... ii., 24
Strathmore Mine ... i., 27; ii., 14, 32, 45
Struggle Mine ... i., 53, 78
Success Mine ... i., 48, 78

Table Top Hill ... i., 51
Ta bot, Mr. H. W. R. ... i., 5, 44
Ta mania Mine ... i., 67, 78
Tr asure Trove Mine ... i., 84, 93
Tr nton Mine ... i., 12; ii., 6, 14, 33, 47
Tr nton Hill ... ii., 7, 8, 9, 31, 34, 45
Tr Again Mine ... ii., 30
Tw light Mine ... i., 53, 78
Tw light South Mine ... i., 54, 78
Tw Lillies Mine ... i., 35, 78
Tw Nations Mine ... i., 28, 78; ii., 45
Ty Mr. R. ... ii., 5

Page

Union Jack Mine ... i., 26, 78; ii., 15, 16,

Venus Mine ... i., 81,
Victoria Mine ... i., 34, 79; ii., 44,
Victory Mine ... i., 34,
Victory United Mine ... i., 80, 81, 83, 85, 88; ii.,
Vogelsang, Dr. ... i.,
Volunteer Group ... i., 51; ii.,
Volunteer Mine ... i., 52,
Volunteer Deep Mine ... i., 53,
Volunteer North Mine ... i., 53,
Volunteer South Extended Mine ... i., 53,

Wallace Mine ... i., 64,
W.A. Venture Syndicate ... i., 64,
Welcome Mine ... i., 39, 79; ii.,
West Australian Mine ... i., 49,
West Fingall, Ltd. ... ii., 28,
West Fingall Mine, No. 6 ... ii.,
Whisper Low Mine ... i., 81,
White Horse Mine ... ii., 12, 14, 36,
Windmill Mine ... i., 81,
Winchester Mine ... i., 64,

Yalgoo Proprietary ... ii., 14,
Young Colonial Mine ... i., 40,

By Authority: Fred. Wm. Simpson, Government Printer, Perth.

LIBRARY
OF THE
UNIVERSITY
OF
CALIFORNIA

LIBRARY
OF THE
UNIVERSITY
OF
CALIFORNIA

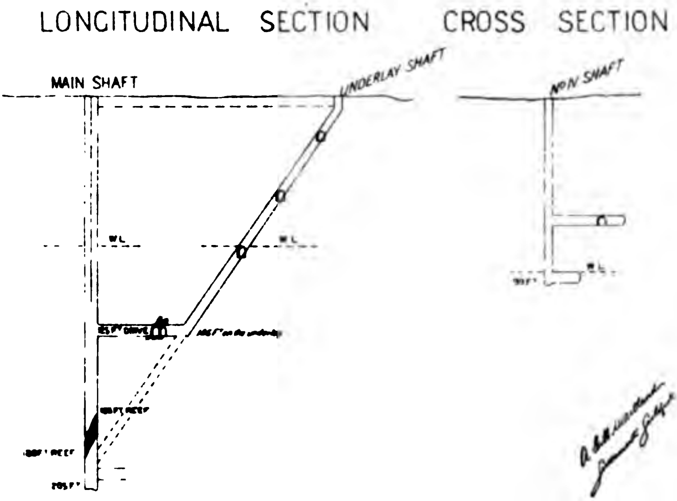
LIBRARY
OF THE
UNIVERSITY
OF
CALIFORNIA

BULLETIN Nº 29 PLATE II
PART 2

The Hon. H. Gregory, M.L.A.
Minister for Mines

SECTIONS OF
THE G^T FINGALL ASSOCIATED G.M.
G.M.L. 334^D / 194^D
DAY DAWN
MURCHISON G.F.

0 100 200 300
Scale of Feet



TAKEN FROM MINE PLANS 30 6 06

H. J. Pether. Government Lithographer. Perth. W. A.

LIBRARY
OF THE
UNIVERSITY
OF
CALIFORNIA

LIBRARY
OF THE
UNIVERSITY
OF
CALIFORNIA

G.
F.
200

RARY
HE
UNI RSITY
CAL RNIA

LIBRARY
OF THE
UNIVERSITY
OF
CALIFORNIA

LIBRARY
OF THE
UNIVERSITY
OF
CALIFORNIA

LIBRARY
OF THE
UNIVERSITY
OF
CALIFORNIA

LIBRARY
OF THE
UNIVERSITY
OF
CALIFORNIA

TION
L L
AWN
G. F.
200
eet.
UMP SHA
ORTH

LIBRARY
OF THE
UNIVERSITY
OF
CALIFORNIA

USE
WHICH BORROWED

ES LIBRARY
date stamped below, or
ich renewed.
ct to immediate recall.

General Library
University of California
Berkeley